# Scientific Agriculture

## La Revue Agronomique Canadienne

VOL. IV. OTTAWA, ONT., OCTOBER, 1923. NO. 2


CONTENTS




*Published Monthly by the Canadian Society of Technical Agriculturists.*

*Forms close on the 23rd day of each month; all copy for advertisements, and changes of advertisements, should be received ten days before the date of issue.*

*All correspondence should be addressed "Scientific Agriculture, P. O. Box* 625, *Ottawa, Ont."*

*Cheques, money orders, etc., must be made payable to the order of the Canadian Society of Technical Agriculturists (C.S.T.A.)*

*Advertising rates on application.*

*Subscription price* $2.00 *yearly to Canada and the United States; other countries* $2.50.

# Technique of Field Husbandry Experimentation.

By

T. M. STEVENSON

*Field Superintendent, Field Husbandry Department, University of Saskatchewan.*

## HISTORY AND DEVELOPMENT OF AGRICULTURAL EXPERIMENTAL WORK.

### Great Britain.

The interest in the application of science to agriculture, which was awakened in western Europe during the early part of the nineteenth century, led to the foundation of the earliest agricultural experimental station. The Rothamsted station, which still continues to be one of the greatest centers of agricultural research, was founded in 1843. Before that time Sir John B. Lawes, who succeeded to the estate of Rothamsted in 1834, had carried on field and laboratory experiments in agricultural chemistry, but it was not until 1843, after having obtained the assistance of Dr. Gilbert, that the famous systematic field experiments were begun.

For a long time Rothamsted was the only station doing agricultural research work in Britain. The next stations were founded by the agricultural societies such as those at Woburn and Pumperton. In 1901 the West of Scotland Agricultural College acquired their station at Holmes Farm, Kilmarnock.

The investigations at Rothamsted made rapid progress. In 1843 systematic field experiments with wheat and turnips were started. In 1847 experiments with leguminous crops, including beans, were commenced and one year later a four course rotation, including clover, was laid out. The year 1851 marked the commencement of the famous wheat, fallow, wheat and beans rotations and also field experiments with barley. In 1856 extensive grass land experiments were begun, making a total of forty acres under experimental work at that time.

The work at Rothamsted is mainly of universal and not merely local application. The investigations have had to do chiefly with crops, fertilizers and soils. At one time some research work was done on animal nutrition, but it was found necessary to discontinue this in order to have sufficient time to deal with the special problems of field and laboratory work relating to plants and soils.

Shortly after the death of Sir John B. Lawes in 1900 and of Dr. Gilbert in 1901, Dr. Russell was appointed director at Rothamsted and the work was reorganized so as to bring it in close touch with modern conceptions of agricultural science. The work, as carried on at present, may be divided into two main divisions or classes, (a) The soil and the healthy plant, (b) The insects, fungi and other agencies disturbing the healthy relationship and causing disease. The acreage under experiments has greatly increased. At present there are nearly three hundred acres devoted to this work. The field experiments which began in 1843 have in some cases continued up to the present day without a break. Nowhere else in the world have such extensive data been collected on soils and fertilizers and their relations to quality and yield of crops.

### United States.

The year 1875 marked the commencement of agricultural experimental work in the United States, since the first experiment station at Middleton, Connecticut, was established in this year. After the passing of the "Experiment station" or "Hatch" Act of 1887 other stations followed rapidly so that at present there is at least one in each state of the union. The passing of the Hatch act led to the establishment of a Department of Agriculture at Washington and marked the beginning of a period of more comprehensive and systematic application of the principles of science to agricultural experimental work.

Following the increased activity of the experiment stations came an appreciation of the advantages of agricultural education and provision was made for more fully developing the agricultural colleges in the several states.

At first the agricultural experiment stations devoted themselves mostly to variety testing and tillage practices, but it soon became

evident that there were still larger problems to be dealt with; the gradual loss of fiber from the soil was leading to serious conditions in some states; the inroads of numerous insects and plant diseases were continually increasing. Ways and means of combating these pests and solving the numerous other problems which continually cropped up, were some of the reasons for the establishing of agricultural colleges, where men could be properly trained to deal with those and similar situations which might confront the farmer.

The work of the stations in all of the states is supervised by the office of experiment stations at Washington. This office also publishes bulletins dealing with special problems and conducts numerous investigations in many parts of the country on a great range of subjects.

## Canada.

In 1885 the House of Commons of Canada appointed a select committee to inquire into means of developing and encouraging the agricultural interests of the Dominion. After a careful study of the subject, the committee submitted a report, recommending the establishment of government experimental farms for the purpose of carrying on research work in all branches of agriculture and horticulture. One year later an act was passed authorizing the government to establish a central farm at Ottawa and four branch farms, one at each of the following places, Nappan, N.S., Brandon, Man., Indian Head, then in the North West territories, and Agassiz, B.C.

Almost thirty-seven years have passed since the establishment of the central experimental farm at Ottawa, under the direction of Dr. Wm. Saunders. During this time Canada has made unprecedented advancement in agricultural experimental work. The number of experimental stations and substations has increased rapidly, there being at present thirty-three throughout the provinces of the Dominion. The comparatively advanced state of Canadian agricultural investigations, as we view them today, is largely due to the patient work upon simple basic problems, carried on by the investigators of these experimental farms.

The Field Husbandry work, to a large extent, consists of the practical application under field conditions, of results obtained through plot investigations. Testing fertilizers, studying crop sequence, farm management, comparative tests of various types and makes of farm machinery and cost of various farming operations are a few of the problems which occupy the attention of the Field Husbandry division.

New varieties of grain are produced by selection and crossing; Marquis wheat, Ruby wheat and Arthur peas are some of the more outstanding products of Field Husbandry work at these farms.

In addition to the Dominion experimental farms all the provinces of Canada, with the exception of New Brunswick and Prince Edward Island, support an agricultural college and an experimental station. The province of Ontario led the way in this work; the Guelph Agricultural College was established in 1874 and has done much to promote the agricultural interests of that province and in fact of Canada as a whole. The district representative work, considered today as an essential and invaluable aid to agriculture, is the outcome of the work of Dr. James while Deputy Minister of Agriculture. Other provinces soon followed the example of Ontario and today most of the provinces of the Dominion have established an agricultural college and experimental station where their problems can be worked out to the best advantage. Their work consists of investigation, teaching and extension. They differ from the Dominion branch farms in that each one is more fully equipped with a staff of the best scientific training, and the necessary equipment and laboratories are provided to enable highly scientific work to be carried on, but a spirit of very close cooperation exists between the two institutions.

Like the Dominion farms the experimental stations connected with the colleges of agriculture carry on numerous field experiments in an endeavour to solve some of the many problems confronting the farmer of today; their records of the past show that much has been accomplished and can still be accomplished along this line. The principles that underlie successful crop growing are being continually dealt with. Many

varieties of crops are being brought into Canada annually for test at these stations and much crossing and selection work is done in an endeavor to produce new and improved varieties. The chemical, botanical and biological branches of these stations do much valuable work in connection with the growing of crops and controlling of pests.

## LAYING OUT AN EXPERIMENTAL FIELD

The manner in which experimental fields are laid out varies greatly. Obviously no hard and fast rule can be laid down which will fit all conditions. Although there is some difference of opinion as to the best methods of laying out the field, yet the following rules may be of some value:

1. The field should be laid out in such a way as to provide for the best possible use of the land.

2. The blocks should be planned so as to accommodate a definite number of plots of a specific size.

3. The series and ranges can be cared for more easily when they are separated by roads of a sufficient length to allow teams to turn without treading on the adjacent plots.

4. The practice of marking the ends of each block by gas pipes, either driven into the ground or embedded in a concrete block with about 1 inch protruding, is a good one and saves considerable time later on.

5. The blocks may be located by the use of number boards, held in place by a post, at the center of either end of series and ranges. The numbers can be painted sufficiently large so as to be visible from any part of the field.

### The Saskatoon Plan.

The Experimental field at Saskatoon consists of fifteen series 132 feet wide. Each series consists of 6 blocks, that run east and west and are separated by roads 33 feet wide of which 27 feet are seeded to grass. The remaining 6 feet provide for a three foot cultivated border on either side.

The ranges which run north and south are eight in number and consist of fifteen blocks each. They are 396 feet wide and are separated by roads 20 feet in width. These roads have been kept cultivated in the past but were seeded to grass during the spring of 1923.

The six ranges of fifteen blocks each make a total of 90 blocks. Each block is 132 feet wide by 396 feet long, having an area of 1.2 acres and each one accommodates 21 plots of .05 acres each together with divisions of 3′-6″ in width.

Each block is provided with markers, consisting of a 12 inch gas pipe embedded in concrete with only one inch protruding above the surface. These are placed in the ground so that the surface of the concrete block is just level with the ground surface. This leaves the ends of the pipe always in view. The first markers used were simply pieces of gas pipe about 16 inches long driven into the soil. Owing to the ease with which these were driven down and covered with dirt, they did not prove satisfactory and were later replaced by the pipes embedded in concrete. The markers are placed in the center of the roads which separate the series, exactly in line with the end of each block and provide an exceedingly easy means of locating the corners of any block at any time.

### Numbering System.

At Saskatoon the series number from 100 to 1500 beginning at the north and numbering to the south. Previous to 1920 they numbered from south to north and from 1 to 15. The ranges number from west to east beginning with No. 3 and numbering to 8.

Under this system any block in the field may be located by first giving the series and then the range number in which it is situated. These numbers are placed on large boards, visible from any part of the field, at the center of each end of the ranges and series. To locate block 306 we would simply refer to series 300 and range 6. This is considerable improvement over the old system in which the ranges were lettered. The chief difficulty with the old method was that even after the block was located, say 5E, it was still necessary to calculate the position of E in the alphabet and count back so that in reality the block would be finally located, not by 5E but by 55. The present system does away with this unnecessary calculation.

The plots also number from west to east and from north to south. Plots of .05 acres or larger number from 1 to 21 for each block, commencing at the north west corner. The label for any plot of this size in any block is marked with both the block number and the plot number together with the size of the plot, thus ("A" 1206-10) would mean an "A class" plot in block 1206 and the 10th plot from the west end. Plots smaller than .05 acre number consecutively from block to block and series to series, always beginning at the north west corner. The labels for such plots are marked only with plot number and class.

## LAYING OUT A BREEDING NURSERY

### Cereals and Other Small Annuals.

In laying out a cereal breeding nursery, one of the two most common methods is usually followed, depending, of course, on the special needs and fancies of the investigator in charge. The oldest method, and one which is quite satisfactory for selection, is "The Centgener Method", Under this method, foundation beds are seeded from which to make selections. These are planted with a planting board, usually in a series across a block. The plants are six inches apart each way and each series is provided with a border of two rows of grain of a different variety to that in the foundation bed.

Selections from the foundation beds are seeded in centgeners, that is, in small plots of one hundred seeds each, also in series across the block and have, in addition to a border around the series, a border around each small plot.

Selections which prove to be up to the standard are next seeded in multiplier plots, which are two rows across a block, usually eight rods long.

The next promotion is to a 0.01 acre plot to be tested with the other varieties.

Although this method has some good points, it may be objected to because of the large amount of unnecessary labor involved in seeding and removing borders and fillers.

In the case of crosses, where only two or three seeds are planted the remainder of the row must be seeded to a filler.

### The Head Row Method.

This is the method now most commonly used. The smallest plots or rows are the head rows which consist of twenty plants each. The plants are three inches apart in the rows and the rows are, six or twelve inches apart in the series. Twenty seeds are planted from each selected head or cross and the remainder is kept for reserve in case of crop failure. Every fifth row of the series is usually planted to a check of a standard variety, to be used for purposes of comparison.

Selections from head rows are seeded in "Rod Rows", which are also in series across a block, but are seeded in drills 1 rod long and one foot apart. All rod rows are duplicated and yields taken from them.

The eight rod row is the next promotion. These also are seeded in duplicate and are usually planted 18 inches apart. Yields are taken from the eight rod rows and those which show considerable promise are placed in .01 acre plots to be tested with the other varieties.

This method is sometimes criticized because it does not provide for the growing of all the seed in the first and second generation, from crosses, but this difficulty may be overcome by keeping crosses and selections in separate series of head rows so that the former may occupy several rows each if necessary.

### Biennials and Perennials.

Obviously a nursery planned to suit the needs of the cereal investigator would not suffice for the breeding of biennial and perennial crops because with the latter it is essential that provision be made for clonal propagation and cuttings as well as by seed. The following plan, in use by several stations, only slightly modified to suit the particular needs of each investigator, has been found to give very good results:

Three sizes of rows or plots are used.

1. Rows one rod long and three feet apart, planted in series across the block. The rows are planted to single plant selections, head selections, clonal selections or cuttings. In the case of plant selections the rows are usually drilled in and these are

planted in a separate series from that in which head selections clons and cuttings are planted. In the case of head selections and cuttings the plants are spaced 18 inches apart in the rows.

Selections from the rod rows are seeded in rows eight rods long and three feet apart. These rows are seeded in duplicate, one half of each may be harvested green to give the yield of hay or green forage and the other half left to ripen for seed.

Selections which prove to be up to the standard are promoted from eight rod rows to 0.01 acre plots, which are also seeded in duplicate and the yield taken as in the eight rod rows.

### Corn.

The "Ear Row" method is now most commonly used in corn breeding work. The different size of plots used in the various steps will depend entirely upon the amount of time and space to be devoted to this work. Usually the rows are 3.5 feet apart and the hills the same distance apart in the rows.

For the first year's seeding selections can be made from various fields. Usually it is best to work with only one or two varieties. Only part of the seed is planted from each ear. The remainder or remnant is preserved in case of crop failure or to seed the following year.

Selections from the first year's crop are made but they are placed on reserve and the remnants of the selected rows left over from the previous year are planted in the second year. All plots should be situated at a considerable distance from other corn fields and poor individual plants in the plots should be detasselled early to prevent them from pollinating the other plants.

The third and future years are similar; selections from either first or second year may be seeded and the same precautions used as with former years.

Plots of any convenient size may be used for increasing selections.

## CLASSIFYING WORK ACCORDING TO SIZE OF UNIT.

### Champlin System.

This system was developed by Manley Champlin while associate agronomist at the South Dakota Experimental Station. The classification is based on size of unit and kind of crop to which it is seeded.

At the University of Saskatchewan the classification is as follows:

A Class—Including all .05 acre plots and larger.

B Class—Including all .01 acre plots.

C Class—Including 8 rod rows of cereals, 12 inches apart.

D Class—Includes only 8 rod rows of annual forage crops, spaced 36″ apart.

E Class—Rod rows of cereals 12 inches apart.

F Class—Includes all rod rows of biennials and perennials, spaced 36″ apart.

H Class—Head rows or five foot rows of cereals spaced 2 inches apart and plants three inches apart in the rows, each row accommodating twenty plants as used in cereal breeding.

P Class—Eight rod rows of biennials and perennials spaced 36 inches apart.

### Reason for Such Classification.

Where various sizes of plots are used, as is usually essential in field experimental work, some convenient system for grouping and referring to such plots is necessary in order to save time and lessen the possibility of error in calculation of yields, etc. The above classification, as can be readily seen, serves this purpose admirably.

Such a classification does away with the possibility of plots, other than those of standard size, being introduced into any set of experiments. The class of plot to be used is always laid down in the project.

The writing up of projects, annual reports, field books, field plans, etc., is simplified to a considerable extent, if some such classification is used.

The labeling of plots in the field can also be simplified under such a system. Each class of plots can be furnished with a different kind of label so that any person familiar with the work may know, at a glance, the size of the plot in any particular project.

The field men soon become accustomed to surveying plots of different classes and the measurements of each class soon become fixed in their memories so that they are not as likely to make errors in measurements as where the actual areas of the plots are given each time.

## Discussion Regarding Shape of Plots.

Most of the difficulties in plot experimentation have been ascribed to variations in soil. Variations in chemical and mechanical composition, depth, drainage and bacterial action all affect plant growth. Early experimenters used fairly large plots of an acre or more. Now the tendency is to use smaller plots which may be replicated and still permit of a greater amount of work being done on the same amount of land, and to make the plots of such shape as to overcome, to the greatest possible extent, the factor of soil heterogeneity.

Obviously the shape is immaterial providing all the land to be laid under plots is absolutely uniform. This condition, seldom, if ever, exists, however, hence the shape of the plot is usually an exceedingly important factor where the influence of the soil variations must be avoided to the greatest possible extent. It is also a feature of considerable importance in considering the ease and cost of caring for plots. The longer the plots, other things being equal, the less the expense owing to time saved in tillage, seeding and harvesting operations.

It is quite generally accepted, as a result of years of experimentation, that the length of the plot should be considerably greater than its width. Usually the ratios of width and length ranging from 1:4 to 1:10 and 1:8 have been found to be very satisfactory for standard variety testing.

There are some objections to plots of this shape however. As practically all plots are separated by alleys ranging from 18" to 42" in width, the outside rows of each plot have a much greater area from which to draw moisture and plant food than the interior rows and hence show much greater growth and higher yield than those near the center of the plots; thus if the object is to get yields which are comparable to field conditions the aim should be to have the perimeter of the plot as short as possible. Obviously the square lot would then serve the purpose better than the long rectangle. In variety testing however, the chief aim is to get comparable results, that is, plots which are under as nearly the same conditions as possible and whose yields can be compared. Again we face a problem. Recent work has shown quite conclusively that different varieties due to different rooting systems do not all draw nourishment from equal distances, thus the border rows on one plot which is sown to a variety that, due to some peculiar characteristic, enables it to draw nourishment from a greater distance in the alley than the next plots, will give an increased yield due to its being able to make use of this extra ground which was not being used by the others. Obviously the yield of such a plot would not be comparable to the others. But due to the fact that the long, rectangular plot serves to overcome the effect of soil heterogeneity to a greater extent than the others, it is generally used for variety test work and the border effect can be overcome by seeding the alleys to grain which can be pulled or cut before the plots are harvested.

## Discussion Regarding Planting of Borders Around Plots.

Border effect has been shown to be a very big factor influencing the reliability of plot tests, and possible methods of preventing its occurrence and of doing away with the extra expense of removing borders before harvesting, are of considerable importance.

In some European stations border effect is overcome by growing varieties in contiguous plots without the intervention of alleys. There are several objections to this method as will readily be seen: (1) Inability to distinguish exactly where one plot leaves off and the next begins when contiguous plots are seeded to similar varieties, say for example Marquis and Red Fife wheats or Victory and Banner oats. (2) The practical impossibility of maintaining varieties pure.

(3) The possible effect of one variety on another where grown in this way, any one variety being flanked on either side by different varieties.

At the Minnesota Station several experiments were carried out with spring sown winter wheat borders around the plots. The winter wheat when seeded in the spring does not head out and so would not have to be removed before harvesting the plots. Comparative yields taken from the border and outer rows of these plots revealed the fact that the rows of winter wheat in the alleys did not prevent border effect sufficiently to be satisfactory for that purpose.

Two years' results of investigations in Minnesota show that under ordinary conditions when winter wheat was not used, the amount of border effect on the third drill from the outside of each plot is not a serious consideration, being almost nil in case of winter wheat plots and very small for spring wheat. The removal of the outside border rows from each plot, before harvesting, gave a reduction in yield of about 10 percent and when the two border rows were removed the yield was reduced approximately 17 percent.

The necessity of considering border effect seriously in plot trials, especially variety tests, cannot be too strongly emphasized. It is possible that under different conditions the effect will vary widely as it does with different varieties, but the removal of at least the outside border rows from each plot is advisable.

## DISCUSSION REGARDING CHECK PLOTS

### Reasons for Using Check Plots.

Check plots are of value as an indication of the care and precision with which the remainder of the work was done. The results of careless work in field experiments can only with difficulty be distinguished from the best. Usually the only criterion, of the accuracy of the work, is found in the deviations of the yields in the check plots. If in any field experiment, several check plots have been well distributed over the area in question and have had the same cultural treatment as the other plots, their average may be taken and the probable error of each check ascertained by comparison with the average. The assumption may be made that each of the nearby, similarly treated plots is equally likely to have the same error.

Check plots are also of value for purposes of comparison. Check plots of a standard variety frequently distributed through a block containing new introductions or strains serve as a means of comparison in note-taking. That is, they form a standard, a measuring stick, with which to judge the nearby plots which are presumably under similar conditions.

Check plots are also of value in determining the variations in the soil of a field before it has been laid out in experimental work. Perhaps the biggest reason for using them is that they permit of a greater amount of work being done on the same amount of land as compared with the system of replication of plots.

### Disadvantages of Check Plots.

The greatest disadvantage in the use of check plots for determining or correcting yields of intervening plots is, that the system is based on the false presumption that the land varies uniformly from one check to another and thereby is likely to produce yields, which in reality never existed and which experiments have shown in some cases to be misleading.

A second disadvantage in the use of check plots which will be discussed later under "replication of plots" is the tremendous amount of figuring in making corrections for the plots between each set of checks.

### Frequency Required.

The relative merits of the different frequencies of check plots is still an unsettled question. Theoretically, the closer the check plot lies to the plot with which it is to be compared the more satisfactory it is, and some experimental evidence supports this hypothesis, but in actual practice the expense and ground required when the frequency exceeds every third or fifth plot, make it undesirable. Some experiments have been carried on to determine the optimum frequency of checks, notably those by Pritchard, at the United States Department of Agriculture, during 1914 and 1915. The frequency which showed the smallest deviation

from the standard was considered the most efficient. All rows were planted to a single variety of as nearly homogeneous seed as could be found, thereby leaving practically only soil variations as a factor to influence yields. These results showed that the greater the frequency the less the deviation from the standard. The use of even every alternate row as a check was not sufficient to offset the variability of yield arising from irregularities of the soil.

In practice the frequency varies from every third to every tenth plot while every fifth plot is used by a large number.

## Replication of Plots.

The practice of planting single plots of each variety, in variety test work, with check plots of some standard variety located at regular intervals throughout, was adopted at a fairly early date by most experiment stations, and has been in some cases continued up to the present time. The essential weakness of this method became more and more evident with each advance in the study of soil heterogeneity.

A study of the effect of various degrees of replication in reducing experimental error was pursued by many experimental stations, and as a result, most experiments of this kind are replicated from two to ten times, depending upon the size of plot used and the amount of land available for experimental purposes.

## Reasons for Replication.

(1) Replication of plots does away with a tremendous amount of calculation, when writing up yields, as compared to the check plot system. The average of all the replicated plots is taken and no more figuring is necessary, whereas in the check row system there are the corrections to be figured for each plot after the yields of all checks have been averaged.

(2) The results of numerous experiments indicate that a greater degree of accuracy accrues as a result of replication of plots due to the fact that such a system tends to overcome soil variations to a greater extent than is possible with the check row method.

(3) Frequently, in field experimental work, a plot is destroyed; gophers may destroy the grain, a wind storm may blow the shock away after harvesting if it is not secured, or numerous other agencies may bring about its destruction. If only a single plot is seeded, as in the check plot system, the yield of this plot is lost for one year, and a break occurs in the records, which, if possible, should be avoided. If the plots are replicated two, three or five times there will still be a number of plots from which to derive the yield, and the resords may be kept continuous. (4) There are some who might, from an ethical viewpoint, state that yields derived as a result of calculation, as in the check plot system, should not be published because they never in reality existed, and there is some ground for such argument, especially when such difficulties may be overcome by replication of plots.

## Amount of Replication Required.

The relative efficiency of different numbers of replications in reducing the experimental error is still a much debated question. The optimum number of replications will, no doubt, be governed largely by the size of plots used and the uniformity of the soil. Experiments to ascertain the most desirable number of replications, have been carried out at different stations and a wide variation of results have been noted. All the work indicates, however, that the accuracy increases with the number of replications but that after eight or ten replications the error is exceedingly small, in all cases, while some work, notably that done by Piper and Stevenson, indicates that from two to five replications of one-twentieth or one fortieth acre plots are sufficient to give results in which the experimental error is so small as to be negligible.

Many experimenters omit the replication of plots because of the increased amount of land necessary, together with an increased amount of labor and hence greater cost. But gradually experimenters are coming to realize that the true test of accomplishment is not "how many" but "how well", for what does it profit a station to save money and lose accuracy of results? The facts are that small replicated plots are better than large single plots and that the increase in land area for such is small, as is also the extra cost of production.

## RECORD KEEPING

### Importance of Keeping Records.

One of the most important considerations in connection with the carrying on of scientific investigational work is the maintenance of complete, systematic and accurate records of all experiments. The primary object of an experiment station or farm is to supply information. This information must be derived from the records or a summary of the records. Therefore, it is quite evident that the maintenance of complete and accurate records is of major importance. Full and complete records are essential to uninterrupted progress. Men are continually shifting. Those who are carrying on work at one place today may be at another place tomorrow. Too often their going means the breaking of the continuity of experiments, because only fragmentary records of procedure and results are left.

Many thousands of dollars worth of investigational work may be wasted annually because of an inadequate record system. No matter how much care and accuracy is applied to the field work, if the data are not recorded completely and accurately, the work is of little avail. The current records of each experiment are of vital importance to the conclusion. Records constitute the crop of the experimental farm and should be harvested with the utmost care.

### Methods of Record Keeping.

Various methods of keeping records are used. Fundamentally these are similar, differing only in minor details to suit the particular needs of each investigator. It is quite obvious that the adoption of standardized methods, in record keeping, for all investigators, would not prove satisfactory, owing to the very different conditions under which they are obliged to work. A system which might be quite satisfactory for an experiment station would probably not be the best for an investigator who conducts experiments at widely separated points. The object of each investigator should be to make his system of record keeping as concise and complete as possible.

### Method of Record Keeping at Saskatoon

The record sheets, books and maps have been made in as simple a form as possible. There are used at the Saskatoon station a total of nine records all of which are permanent.

### The Accession Book.

This book constitutes a record of the sources of all varieties and strains tested. One book is used for all crops. Every variety or strain has a number and occupies one line on a page. The column headings are as follows. (1) Accession numbers. (2) Date received. (3) Name. (4) Source and remarks, under which is noted the type description. New introductions are also listed in the accession records. The following is a sketch of a page from the Accession Book:

UNIVERSITY OF SASKATCHEWAN.

Field Husbandry Department.

ACCESSION BOOK.

Abbreviations. A—awnless. W.C.—white chaff. R.—red kernel B.—bearded

| Date Received | Name. | Source | Remarks | Accession Number |
|---|---|---|---|---|
| 1917 | Siberian | Paul Gerlach, Allan, Sask. | Durum wheat Tr. S. Durum B. | 42 |
| 1916 | Kitchener | S. Wheeler, Rosthern, Sask. | Common wheat, A.W.C.R. Tr. S. Vulgare | 43 |
| | | | | 44 |

The accession numbers also apply to a card index which gives more details, a card being reserved for the history of each variety.

## The Project Book.

This book gives a complete, detailed outline of each experiment, the object, size of plot and procedure being clearly outlined. It

| NAME OF CROP<br>VARIETY NAME | Wheat<br>Acme | Wheat<br>Marquis | Wheat<br>Kubanka | Oats<br>Banner | Oats<br>Victory | Barley<br>Han.-nchen | Rye<br>Rosen | Rye<br>Dak-old | Flax<br>Crown | Flax<br>Pre-most |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| SASK. NO. | 450 | 7 | 6 | 144 | 103 | 229 | 297 | 295 | 272 | 268 |
| No. of Plot or Row | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 |
| Size of Plot or Row | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 | .05 |
| Rate of Seeding—lbs. | 80 | 80 | 80 | 68 | 68 | 72 | 75 | 75 | 30 | 30 |
| Year planted | 1922 | | | | | | | | | |
| (For Perennials) | | | | | | | | | | |
| Date Planted | | | | | | | | | | |
| | | | | | | | | | | |
| Date of Emergence | 5-30 | | | | | | | | | |
| Stand in June | | | | | | | | | | |
| Stand in September | | | | | | | | | | |
| Survival in May | | | | | | | | | | |
| (For Alfalfa, Clover Rye, etc.) | | | | | | | | | | |
| Date Headed 75 p.c. | 6-26 | | | | | | | | | |
| Date Ripe | 7-28 | | | | | | | | | |
| Height in Inches | 18 | | | | | | | | | |
| Length of Heads (For Cereals etc.) | 3 | | | | | | | | | |
| | | | | | | | | | | |
| DISEASE INFECTION | | | | | | | | | | |
| Covered Smut | | | | | | | | | | |
| Loose mut | 2% | | | | | | | | | |
| Leaf Rust | | | | | | | | | | |
| Stem Rust | 6% | | | | | | | | | |
| | | | | | | | | | | |
| YIELDS | | | | | | | | | | |
| Total Weight—lbs. | 271 | | | | | | | | | |
| Grain or seed wt., lbs. | 111 | | | | | | | | | |
| Straw Weight—lbs. | 160 | | | | | | | | | |
| Grain—lbs. per acre | 2220 | | | | | | | | | |
| Straw—lbs. per acre | 3200 | | | | | | | | | |
| Grain—Bu. per acre | 37.00 | | | | | | | | | |
| Grain—Wt. per Bu. | 66 | | | | | | | | | |
| Hay, dry—1st Cut | | | | | | | | | | |
| Hay, dry—2nd Cut | | | | | | | | | | |
| Hay—Total Wt. lbs. | | | | | | | | | | |
| Hay—lbs. per acre | | | | | | | | | | |
| | | | | | | | | | | |
| MISCELLANEOUS | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

PAGE OF FIELD BOOK

may be considered as the second of the record books and is of greatest importance. If at any time the field superintendent is at a loss to know just how certain plots are to be treated he can turn to this "Project Book" where a complete and detailed procedure is given; thus the same methods can always be used and no matter who may be in charge of the field work, it aids very materially in promoting continuity of methods and results.

### The Project Plan Book.

This book is 12 inches x 14 inches in size and made of paper ruled into squares ¼ inch on a side, thus providing a method by which blocks or plots of any size may easily and quickly be plotted. Each project is drawn on a separate page and each block divided into the correct number of plots. The name of crop with its accession number is inserted for each plot. Such a record is a valuable aid in enabling one to see at a glance the exact position of any plot and also the history of the whole experiment.

### The Field Books.

These are books of a convenient size to fit the pocket, about 8 inches x 4 inches and have printed headings under which the various field notes are entered. Each double page is ruled into ten columns as shown on sample page. (*see page* 50.)

Each page thus takes care of ten plots or rows and a book of 100 pages is sufficient for 1000 plots. The first page of each book carries an index to the material within. These books are prepared in duplicate several weeks before seeding time; one copy is carried by the field man in charge of that certain part of the work, and he enters all notes, such as date of seeding, time of emergence, date of harvesting, etc. in the field. The second copy is kept in the office and each day the notes are copied from the foreman's book into it, thus providing a duplicate record in case one becomes lost or destroyed. These books have simplified, to a large extent, field note taking. In addition to the printed headings, the books are provided with charts which enable the person taking notes to judge fairly accurately the percent of damage by rust, etc.

### The Field Plan Book.

This book is of the same size and made of similar paper to the project plan book. It shows in detail, duplicate plans of the entire experimental field. In one plan is noted the tillage given to each block, the date done, depth in case of plowing and if manure is applied the amount per acre and date of application. On the second plan the class of plot to which it is planted, whether "A Class", "B class", etc., the variety and accession number, and date planted are noted. The various blocks allotted to each project are outlined in red ink. As each block is seeded, the date is entered and thus we get a record of the field work done each day and in addition, a plan which shows at a glance the exact location of any particular project.

### The Record Sheets.

These sheets are 18 inches x 24 inches in size and ruled into columns over which the headings may be written. As soon as all harvesting and threshing is completed and the seed cleaned, the yields of replicated plots are averaged and entered on "The Record Sheets". In addition these sheets contain a complete replication of the information found in the field books. As soon as the data are summarized and incorporated in the annual report, these sheets are stored in the vault for safety in case of fire.

### The Annual Reports.

The person in charge of each of the divisions of cereals, forage crops, etc., prepares an annual report which contains the results of the current year's work, together with a summary of the results of the experiment since it was started. This forms another permanent record and provides a source from which data concerning any particular part of the work can always be obtained in summarized form. This record is a great time saver when information is required.

### Photographs.

Photographs may be considered as another form of record. Cost and time, however, do not permit the obtaining of anything approaching a complete record in this form. Nevertheless, sufficient photographs are obtained of typical results to form a valuable record.

Blocks 807 and 808

RECORD SHEET
WINTER RYE VARIETIES AND MANAGEMENT 1922. "A CLASS."

| Plot Number. | Variety Name. | Saskatchewan No. | Rate of Seeding. | Date of Seeding. | Date of Emergence. | Stand in Sept. | Survival in May. | Date Headed. | Date Ripe | Height in Inches. | Length of Heads. | % Ergot. | % Leaf Rust. | % Stem Rust. | Total Weight per Plot. | Weight of Grain per Plot. | Weight of Straw per Plot. | Weight of Grain per Acre. | Weight of Straw per Acre. | Weight per Measured Bushel. | Number of Days to Mature. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dakold.. | 295 | 70 | 8- 1 | 8-7 | 90.0 | 87.5 | 6-4 | 7-18 | 46. | 3. | 0 | 0 | 0 | 230.5 | 89.0 | 141.5 | 1780 | 2830 | 53.5 | 351 |
| 2 | Sask... | 291 | 70 | 8-26 | 9-1 | 92.5 | 94.0 | 6-5 | 7-23 | 44.5 | 3.25 | 0 | 0 | 0 | 200.0 | 86.5 | 113.5 | 1730 | 2270 | 56.0 | 331 |
| 3 | Rosen.. | 299 | 70 | 8-26 | 9-1 | 85.0 | 62.5 | 6-7 | 7-25 | 47.0 | 3.25 | 0 | 0 | 0 | 215.0 | 95.5 | 119.5 | 1910 | 2390 | 55.5 | 333 |

**Seed Distribution Book.**

This book can hardly be considered as part of the experimental record but it forms a record of all grain and seed of any kind shipped during the year, the person to whom it was shipped, date of shipping, amount shipped and amount on hand at any particular time.

## MACHINERY.

The question of how much use can be made of ordinary implements in performing the various operations connected with field experimental work, is one which merits much careful study. There are some who believe that field experimental work should be carried on under as nearly practical farm conditions as possible. Much of the work, such as tillage operations, can be carried on by methods and machinery similar to those employed by a careful farmer, but when we consider seeding and harvesting, quite another question arises.

The plant breeder exercises great care and considerable time in crossing and selection and from the time a selection is made until it is promoted to the variety test plots, it is handled with extreme care to prevent mixing with other varieties. If at this stage methods of seeding, harvesting, etc. are introduced which greatly increase the possibility of the selection becoming impure, then they are not the best methods. It may seem like economy, for example, to dump seed into a drill and seed three plots in the same time that one was seeded previously or to cut a plot in five minutes which took 40 minutes to cut by hand, or to thresh a plot in a very few minutes which would take much longer to flail out in a sack by the old method, but there is considerable evidence to indicate that even with the utmost care and precaution mixing has occurred to a considerable extent by the use of machinery.

It is almost impossible to clean every kernel of seed out of a drill after seeding one variety and before seeding the next one; seeds become jammed in crevices and corners and later work loose and fall out. The same applies to threshing machines but can be overcome to some extent, although not wholly, by threshing alternate plots of dif-

ferent cereals, that is, an oat plot after wheat, wheat after barley, etc., but even then there is almost sure to be some mixing.

Mixing, due to the use of machinery, may be overcome by hand selecting, from each varietal plot, enough heads to furnish pure seed for the plots of the following year. At Saskatoon, such selections are made every second year. The seed selected is dried in sacks and threshed by hand to prevent mixing, and the yield is added to the yield of the grain from the remainder of the plot which is harvested in the ordinary way. This method involves considerable time and labor, but when done only every other year, does not take nearly so much time as when all the work is done by hand.

The purchasing of machinery for experimental purposes should be given careful study. There are certain special requirements which should not be overlooked.

### Plows.

Almost any make of plow will work quite well but there are some better than others. It is very undesirable, in experimental work, to leave a dead furrow or ridge in the center of a block. The ordinary gang plow or sulky provides no way of overcoming this difficulty unless the plowing is done all one way, driving back without plowing, which means much lost time. This difficulty can be overcome by the use of a two-way plow which allows the furrows to be thrown all one way if necessary and may be used as an ordinary gang or sulky plow.

### Seeders.

The type of seeder used will depend largely upon the type of soil for which it is wanted. On loam soils a double disk seeder is usually very satisfactory. For sandy and light soils a single disk with the press attachment is desirable, while clay soils almost necessitate the use of single disks without the press attachment. The drill should be so constructed as to permit of easy cleaning; braces, truss rods, etc. inside the grain box are undesirable from the standpoint of cleaning the drill. If seeding plots, small hand bellows serve very nicely for blowing seed out of the gears.

### Cultivators.

The duckfoot cultivator is almost indispensible on the medium and lighter types of prairie soils. In some cases it may be made to serve the purpose of a row cultivator by removing some of the shovels. A two horse corn cultivator and a one horse scuffler, if used properly, are great labor savers.

### Binders.

For plot work an ordinary binder with a five foot cut is very satisfactory. It can be drawn by two horses which makes it much easier to operate around plots than when four horses are required.

### Threshing Machines.

Many different types of threshing machines are placed on the market, and for ordinary work most of them do fairly well. For experimental work, the machine should be so constructed as to allow easy and rapid cleaning between plots, otherwise much time will be lost and grain mixed. It is a small job to provide a slide in the drum under the cylinder and thus provide an easy method of cleaning that part. The body of the machine should be absolutely tight; cracks and crevices are sure to harbor seed and cause mixing. For nursery threshing, a small machine consisting of cylinder and fan gives the best satisfaction.

### Scales.

Much of the results of experimental work depend on accurate weighing. This can only be done if good machines are provided for the purpose. Several sets of scales of different sizes are necessary and before being used they should always be tested to ascertain if they are correct.

### Care of Machinery.

It is a good practice to overhaul all machinery thoroughly during the winter months. Badly worn and broken parts should be replaced as they are likely to give trouble and cause loss of time during the rush seasons. Those entrusted with the use of machinery

should be impressed with the necessity of sufficient lubrication. When not in use, it is a good plan to grease all bright steel parts to prevent rusting.

ACKNOWLEDGEMENT

The preceding manuscript was written at the Field Husbandry Department, University of Saskatchewan, under the direction of Professor Manley Champlin. The writer feels indebted to Professor Champlin for suggesting the subject and for assistance given in the selection of material. His suggestions on methods of experimentation are fully appreciated and only through his efforts has much of the material here presented been made available.

BIBLIOGRAPHY.

Hayes, H. K. and Arny, A. C. Experiments in field technique in rod row tests. Journal of Agricultural Research, Vol. 11, pp 399-419. 11-26-17.

Jardine, W. M. Size of plots for field experiments with crops. Journal of the American Society of Agronomy, Vol. 9, pp 402-405. December 1917.

Kiesselbach, T. A. Studies concerning the elimination of experimental error in comparative crop tests. University of Nebraska. Agricultural Experiment Station Research Bulletin 13. pp 1-95. 1918.

Wiancko, T. A. Use of check plots in field experiments. Journal of the American Society of Agronomy, pp 410-415. December, 1917.

Day, J. W. Relation of size, shape and number of replications of plots to probable error in field experimentation. Journal of American Society of Agronomy, pp 100-105, March, 1920.

Arny, A.C. Further experiments in field technique in plot tests. Journal of Agricultural Research. pp. 483-500. July 1, 1921.

Champlin, M. Technique of field husbandry experimentation. Scientific Agriculture, pp 14-18. September, 1921.

Champlin, M. Field Husbandry experiments in relation to farming. Agricultural Gazette of Canada. pp 640-641. November, 1921.

Arny, A. C. and Garber, R. J. Field technique in determining yields of plots of grain by the rod row method. Journal of the American Society of Agronomy. Vol. 11, No. 1, pp 33-47. 1911.

Arny, A. C. and Stemmetz, F. H. Field technique in determining yield of experimental plots by the square yard method. Journal of the American Societyof Agronomy. Vol. 11, No. 3, pp. 81-106. 1919.

Morgan, J. O. Some experiments to determine the uniformity of certain plots for field experiments. Proc. American Society of Agronomy. 1. pp 58-67. 1910.

McClaskey, E. G. Methods of laying out field experiments. Proc. American Society of Agronomy. 3. pp 103. 1911.

Pritchard, F. J. The use of checks and repeated plantings in varietal tests. Journal of the American Society of Agronomy. Vol. 8, No. 2 pp. 65. 1916.

Hall, A. D. The Book of Rothamsted Experiments, pp 1-40.

Spencer, J. B. Review of Dominion Experimental Farms. 1886-1912.

Saunders, W. Evidence Before Committee on Agriculture and Colonization. 1901.

Proceedings of the Association of American Agricultural Colleges and Experimental Stations. 33rd Annual meeting.

Arny, A. C. Border effect and ways of avoiding it. Journal of the American Society of Agronomy. Vol. 14, pp 266.

# The Most Important Poisonous Mushrooms.

R. E. STONE

*Associate Professor of Botany, O.A.C. Guelph*

During the autumn season mushrooms usually become quite plentiful. They have had a warm season to develop their vegetative portion or spawn, and are now ready to fruit. The mild days lure many people to the woods and pastures where they hope to secure some choice addition to the ordinary diet. Since some mushrooms are edible and others poisonous, we are asked to give some easy test by which the edible mushrooms may be distinguished from the poisonous ones. The question is sometimes put in this way—"How can you tell mushrooms from toad stools?"

There is no simple test by which poisonous mushrooms can be separated from the edible ones. One sometimes hears of the peeling test. Some mushroom lovers imagine that if the skin can be peeled easily from the cap, the mushroom is edible. Many of the edible mushrooms can be peeled while some of the best can not be peeled at all. On the other hand, some of our deadly poisonous forms, as the Fly Agaric, can be peeled as readily as the cultivated mushroom. Another test sometimes cited, is the silver test. Not long ago the following paragraph appeared in several newspapers. "A Test for Mushrooms." "To test the healthfulness of mushrooms stir with a silver spoon. If there is any foreign substance in them the silver will turn." This so-called test indicates that the mushrooms are in a more or less advanced state of decomposition. Let it be repeated—*there is NO simple test for mushrooms.*

How then, are we to identify the poisonous mushrooms? This can only be done by learning to know them the same as we learn to know any other plant. Since the dangerously poisonous mushrooms are relatively few in number this is not a difficult task. Out of over two hundred fleshy fungi in Ontario, less than a dozen are really dangerous and only four of these are at all common. Nearly all the fatalaties are caused by but two. It will be comparatively easy to learn to know these few species.

## DEADLY AGARIC (Fig. 1)

*(Amanita phalloides Fr.)* Deadly poisonous.

This mushroom is commonly found in deep woods but sometimes occurs in the leaf mould in the borders of woods, or even in lawns built up from forest soil. The plant is quite large, six to ten inches high with a cap three to five inches broad. The cap is at first hemispherical, later becoming nearly flat. The cap is usually olive in colour but sometimes white. The stipe or stalk is white.

(Fig. 1)

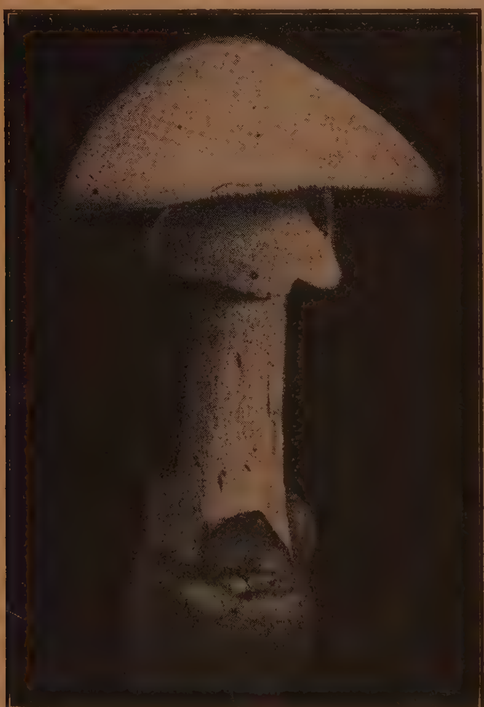
The gills are white and remain white until the plant decays. There is a large white ring on the stipe usually above the middle. *At the base of the stipe there is a large cup or sack-like structure* from which the mushroom arises. This cup, sometimes called the poison cup or volva, is the most distinctive feature of this mushroom and the plant *must be dug up* in order to see this structure.

In this plant we have the main characters of all the dangerously poisonous mushrooms. The gills are white and do not change colour, there is a ring on the stalk and a *volva* or *cup* at the base.

DESTROYING ANGEL (Fig. 2)

(*Amanita verna* Bull.) Deadly poisonous.

This is a very pretty and wholesome looking mushroom. It is a pure ivory white and seldom disfigured by insect attack. The plant usually grows in the woods but like



(Fig. 2.)

the preceding may occur in the borders of woods or even in lawns that have been built up from forest soil. This plant is from four to six inches high, with a cap of two to four inches broad. The whole plant is a pure ivory white and slightly slimy when moist. The gills are white and remain white, there is a prominent ring on the stalk and the *stalk arises from a distinct sack or cup-like volva as in the preceding case.*

FLY AGARIC (Fig. 3.)

(*Amanita muscaria* Linn.) Deadly poisonous

This is one of the most beautiful of mushrooms. It grows generally in open hard woods, often in more or less gravelly soil. The mushroom is from six to ten inches high and the cap from four to eight inches broad. The colour of the cap varies from yellow to red and is covered with scales of contrasting colour, which may be white or light yellow. These scales are not a part of the cap itself but are formed by the breaking up of the volva or poison cup, hence they can be readily brushed from the cap and after light rains the cap may appear smooth and either plain yellow or red. The stalk or stipe is stout and white or very pale yellow. There is a very prominent white ring usually about the middle of the stalk. The gills are white or very pale yellow or creamy and do not become discoloured with age. The volva or poison cup is not as distinct in this plant as in the preceding. In this plant the poison cup generally appears as an abrupt bulb at the base of the stalk, as the top half of it has been broken into fragments to form the scales on the cap. The lower part of the stalk is usually rough and haggy with white scales.

FROSTS AGARIC OR SMALLER FLY AGARIC.

(*Amanita frostiana* Pk.) Poisonous

This mushroom looks much like the preceding except that it is smaller, being only three to six inches high and two to three inches across. The scales on the cap are usually smaller and more numerous while the volva or poison cup is less conspicuous.

Our deadly poisonous mushooms are confined to the genus *Amanita* and have the following characteristics in common: — 1. Gills are white or sometimes creamy and never become discoloured with age. 2. Stalk is white. 3. Ring is white and quite prominent. 4. There is a volva or poison cup at the base of the stalk which appears either as a very distinct cup or sack, or as an

abrupt bulb with the fragments adhering to the cap. If all mushrooms having these characters are avoided there is little danger in eating mushrooms from the forest and field.

There are a number of mildly poisonous mushrooms, the red mushroom *(Russula emetica)* known by its bright red cap and absence of both ring and poison cup. The Pepper mushroom *(Lactarius piperitus)* should be avoided on account of its very pronounced peppery taste. The Jack o' Lantern is another one to avoid. This mushroom is a large sulphur yellow plant, funnel shaped and it grows in clusters on stumps.

## Rules for Collecting Wild Mushrooms

It is impossible to give a simple rule for collecting mushrooms. The following suggestions will prove helpful:

Dig up the plant in order to get the base of the stalk and to see if there is a volva or poison cup. Never pull the plant up as this will in most cases destroy any evidence of the volva. Discard any plant showing evidence of decay or the work of insects. In general mushrooms in the button stage should be avoided unless there are mature specimens near by which can be carefully observed.

In collecting mushrooms the following should be discarded:

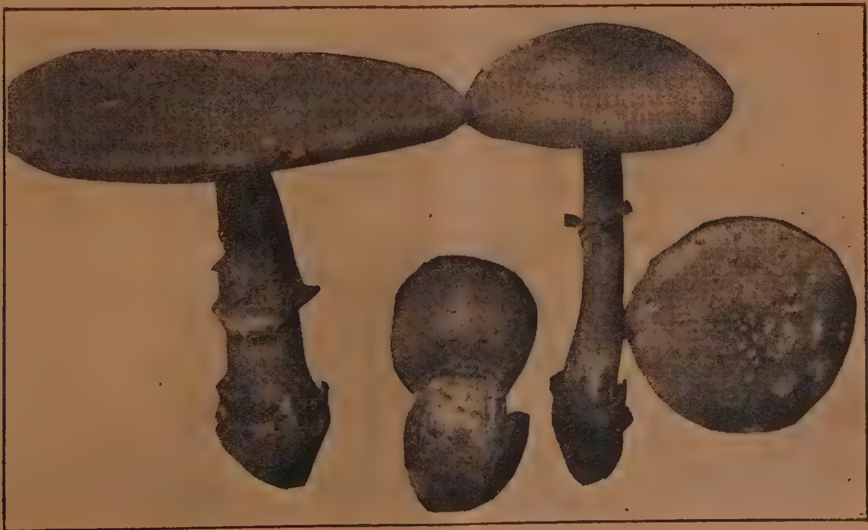
1. All mushrooms showing signs of decay or the work of insects.
2. All mushrooms which have a cup or abrupt bulb at the base of the stalk and loose scales on the cap, especially if the gills are white.
3. All mushrooms having a milky juice, unless the milk is orange in colour.
4. All mushrooms in which the cap is thin and very brittle, especially if the cap is red or green.
5. All mushrooms having pores in place of gills, especially if the flesh changes colour when cut or broken.
6. Hard, woody or tough plants are not worth gathering.
7. In case of doubt discard the plant.

## Mushrooms Which May be Gathered.

The foregoing rules are given to warn against a comparatively few plants. The edible fungi are numerous and those that may be gathered are as follows: All the puff balls, all coral fungi, hedge hog or spiny fungi; any mushrooms whose gills become brown, mushrooms having an orange juice; all those that melt down into an inky liquid when mature. Mushrooms having white gills must be carefully examined so that any having a poison cup or volva may be avoided.

## Some Books That May Prove Helpful.


1. Atkinson, Mushrooms, poisonous, edible, etc.
2. Hard, Mushrooms Edible and Otherwise.
3. McIlvane, One Thousand American Fungi.
5. Marshall, The Mushroom Book.
4. Massee, British Fungi and Lichens.
6. Stone, Mushrooms of Ontario, O.A.C. Bulletin 263.

(Fig. 3)

# Differential Sex Growth Curves in Barred Plymouth Rock Chicks.

By MORLEY A. JULL.

A determination of the degree to which growth rate of the sexes in chicks may differ is a necessary preliminary step in the solution of major problems concerning growth curves in general. The standard weight for cockerels is considerably heavier than that for pullets in practically all breeds of chickens. It is interesting to enquire, therefore, if the cockerels and pullets attain their respective standard weights at the same age or do pullets tend to grow at a slower rate than cockerels? If the rate of growth in the sexes is the same, then the original weight of the pullets at hatching time must be less than the orginal weight of the cockerels at hatching time. The original weight of the sexes at hatching time might differ and the rate of growth might be the same, in which case the sexes would naturally attain a different weight at maturity. On the other hand, the original weight at hatching time might differ and the rate of growth might also differ, in which case the pullets would attain standard weight relatively earlier or later than the cockerels, depending upon the degree to which the pullet growth rate was greater or less than the cockerel growth rate. Such is the nature of the problem involved in this preliminary study.

It must be borne in mind that this is not a study of a normal or standard growth curve for Barred Plymouth Rock chicks. There are many factors that must be taken into consideration in determining a so-called normal or standard growth curve for any breed of chicks. The chicks at maturity should approximate standard weight and while being reared they should be fed the most suitable rations, these rations being fed in such a way as to maintain health and promote normal growth, and the chicks should also be provided with the best possible environmental conditions. Moreover, it is quite probable that even where all of these conditions are met, normal growth curves for the same strain of the same variety, strains of the same variety probably differing considerably in rate of growth, determined in widely separated sections of the country might not be the same because of seasonable variations in the respective sections of the country where the growth curves are determined. The determination of a so-called normal growth curve for any class of chicken in any particular section of the country involves several factors which should be taken into consideration. This study was made primarily for the purpose of determining the difference in rate of growth of female and male Barred Plymouth Rock chicks of the same breeding and reared under identical conditions.

## MATERIAL.

The chicks, on which growth rate records were obtained, were hatched from eggs laid by seventeen Barred Plymouth Rock females in the flock at Macdonald College, McGill University. The females were of an inbred strain characterized as an early-laying strain which tended to lay eggs somewhat below standard weight, the females themselves being somewhat below standard weight.

The eggs from which the chicks were hatched were weighed carefully the day they were laid and they were incubated in three different lots. The first lot of chicks was hatched on March 29th, the second on April 8th, and the third on April 22nd. The method of incubation was uniform throughout.

The chicks were first weighed at hatching time and weekly thereafter, these weights being taken in the morning before the chicks were fed. The method of feeding and the general management of the lots of chicks were uniform throughout the test, the sexes being reared together until about twelve weeks of age.

All of the weighings were recorded by Mr. A. J. G. Maw, a recent graduate of Macdonald College.

## RESULTS.

The results show, first, the correlation between egg weight and chick weight; second, the mean weight of the eggs producing female and male chicks, respectively; third, the mean weight of the female and male chicks, respectively; fourth, the rate of growth of the three lots of females and males, respectively; fifth, the rate of growth of all females and males, respectively, as measured by the weekly mean weight; sixth, the pullet growth rate in relation to the cockerel growth rate by showing the weekly mean pullet weight as a percentage of the weekly mean cockerel weight.

**TABLE 1.—SHOWING THE CORRELATION BETWEEN EGG WEIGHT AND CHICK WEIGHT.**

$r = 0.720 \pm 0.037$

| Mean Chick Weight in Grams | Mean Egg Weight in Grams | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | |
| 27 | | | | | | 1 | | | | | | | | | | | | | | | | | | 1 |
| 28 | | | | | | | 1 | | | | | | | | | | | | 1 | | | | | 2 |
| 29 | | | 1 | | | 1 | | 1 | | | | | | | | | | | | | | | | 3 |
| 30 | 1 | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | | | | 6 |
| 31 | | | | 1 | 1 | | 1 | 5 | 3 | | | | | | | | | | | | | | | 11 |
| 32 | | | | | 1 | | | | | 2 | 2 | | | | | | | | | | | | | 5 |
| 33 | | | | | | | | 1 | 1 | 1 | 1 | 1 | | | | | | | | | | | 1 | 6 |
| 34 | | | | | | | | 1 | 1 | | | 1 | | 1 | | | | | | | | | | 4 |
| 35 | | | | | | | | 1 | 1 | | 1 | | 2 | | | 1 | | | | | | | | 6 |
| 36 | | | | | | | | 1 | | | | 2 | | | | | | | | | | | | 3 |
| 37 | | | | | | | | | | | | 3 | 2 | 1 | | | 1 | 1 | | | | | | 8 |
| 38 | | | | | | | | | | | 2 | | | 3 | 1 | | 1 | | | | | | | 7 |
| 39 | | | | | | | | | | | | | | 1 | 2 | | | 1 | | | | | | 4 |
| 40 | | | | | | | | | | | | | 1 | | 1 | | 1 | | 2 | 1 | | | | 6 |
| 41 | | | | | | | | | | | | 1 | | | | 1 | | | | | | | | 2 |
| 42 | | | | | | | | | | | | | | | | | | | | 1 | | | | 1 |
| 43 | | | | | | | | | | | | | | | | | | | | | | | | 0 |
| 44 | | | | | | | | | | | | | | | | | | | | | | | | 0 |
| 45 | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 |
| | 1 | 0 | 1 | 1 | 2 | 3 | 3 | 11 | 6 | 4 | 6 | 8 | 6 | 6 | 4 | 2 | 3 | 2 | 3 | 2 | 0 | 1 | 1 | 76 |

The correlation between egg weight and chick is significant since $r = 0.720 \pm 0.037$, as shown in Table 1.

Table II has been compiled of Parts A and B for the purpose of saving space. In Part A it is shown that the mean weight in grams of eggs producing females is $50.05 \pm 0.53$ and of eggs producing males $52.11 \pm 0.41$. The difference in weight with its probable error is $2.06 \pm 0.67$, which is significant. Part A also shows that the variability in weight among the eggs producing females is somewhat greater than the variability in weight among the eggs producing males,

9.78±0.76, as compared with 7.25±0.56. In Part B it is shown that the mean weight in grams of the female chicks is 33.72±0.42 and of the male chicks 36.31±0.45. The difference in weight with its probable error is 2.59±0.61,which is significant. Part B also shows that the variability in weight among the females is slightly less than that among the males, 10.59±0.88 as compared with 10.96±0.87. The variability among the eggs was less than that among the chicks, being 8.79±0.48 for all eggs as compared with 11.31±0.62 for all chicks.

The growth curves for each lot of female chicks, according to date hatched, are shown in Figure I, and the growth curves for each lot of male chicks, according to date hatched, are shown in Figure II. In each Figure the curves follow the same trend, showing that the dates of hatching specified apparently had no outstanding affect on rate of growth.

The weekly mean weights for the thirty-eight female chicks are shown in Table III, and for the thirty-eight male chicks in Table IV. Growth curves based on the weekly mean weights are shown in Figure III, which

**TABLE II.**

**Part A.—Showing the Frequency Distribution and Mean Weights of Eggs Producing Female, Male, and Total Chicks.**

**Part B.—Showing the Frequency Distribution and Mean Weights of the Female, Male, and Total Chicks.**

| Part A. | | | | Part B. | | | |
|---|---|---|---|---|---|---|---|
| Egg Weight in Grams | Eggs Producing | | | Chick Weight in Grams | Females | Males | Total |
| | Females | Males | Total | | | | |
| 40.00—40.99 | 1 | | 1 | 27.00—27.99 | 1 | | 1 |
| 41 | | | | 28 | 2 | | 2 |
| 42 | 1 | | 1 | 29 | 3 | | 3 |
| 43 | 1 | | 1 | 30 | 4 | 2 | 6 |
| 44 | 1 | 1 | 2 | 31 | 6 | 5 | 11 |
| 45 | 2 | 1 | 3 | 32 | 1 | 4 | 5 |
| 46 | 3 | | 3 | 33 | 5 | 1 | 6 |
| 47 | 7 | 4 | 11 | 34 | 2 | 2 | 4 |
| 48 | 3 | 3 | 6 | 35 | 3 | 3 | 6 |
| 49 | 3 | 1 | 4 | 36 | 3 | | 3 |
| 50 | 2 | 4 | 6 | 37 | 1 | 7 | 8 |
| 51 | 3 | 5 | 8 | 38 | 3 | 4 | 7 |
| 52 | 1 | 5 | 6 | 39 | 1 | 3 | 4 |
| 53 | 2 | 4 | 6 | 40 | 2 | 4 | 6 |
| 54 | 1 | 3 | 4 | 41 | | 2 | 2 |
| 55 | 1 | 1 | 2 | 42 | 1 | | 1 |
| 56 | 2 | 1 | 3 | 43 | | | |
| 57 | | 2 | 2 | 44 | | | |
| 58 | 2 | 1 | 3 | 45.00—45.99 | | 1 | 1 |
| 59 | 1 | 1 | 2 | | | | |
| 60 | | | | | | | |
| 61 | | 1 | 1 | | | | |
| 62.00—62.99 | 1 | | 1 | | | | |
| Totals | 38 | 38 | 76 | Totals | 38 | 38 | 76 |
| Mean Weight | 50.05 | 52.11 | 51.08 | Mean Weight | 33.72 | 36.31 | 35.02 |
| Em | ±0.53 | ±0.41 | ±0.35 | Em | ±0.42 | ±0.45 | ±0.31 |
| Std. Dev. | 4.90 | 3.78 | 4.49 | Std. Dev. | 3.57 | 3.98 | 3.96 |
| E. s. d | ±0.38 | ±0.29 | ±0.25 | E. s. d. | ±0.30 | ±0.32 | ±0.22 |
| C. V. | 9.78 | 7.25 | 8.79 | C. V. | 10.59 | 10.96 | 11.31 |
| E. c. v. | ±0.76 | ±0.56 | ±0.48 | E. c. v. | ±0.88 | ±0.87 | ±0.62 |

Figure I.—Showing Rate of Growth in Barred Plymouth Rock Female Chicks.

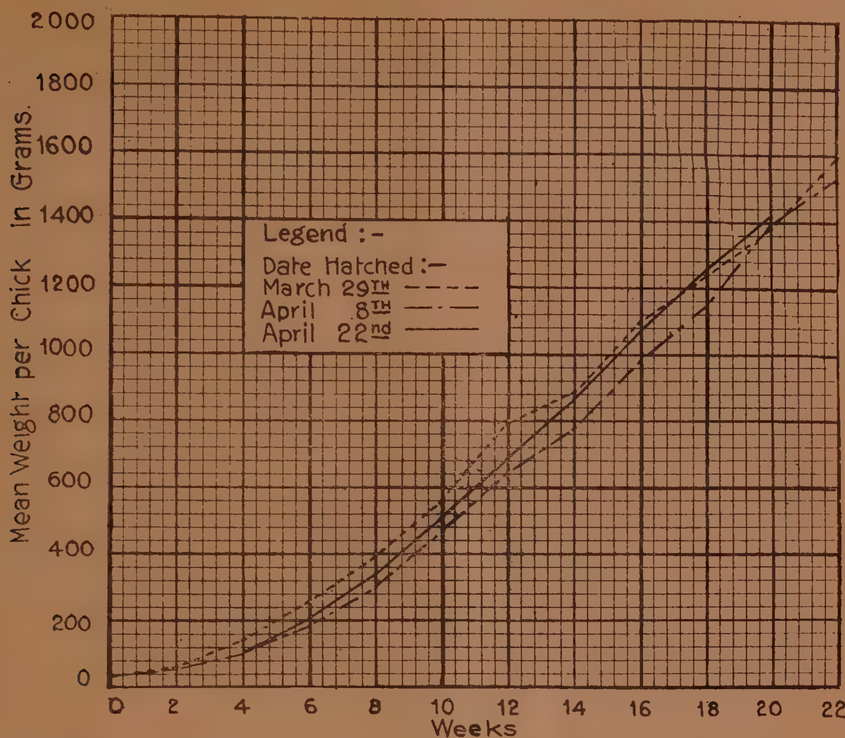
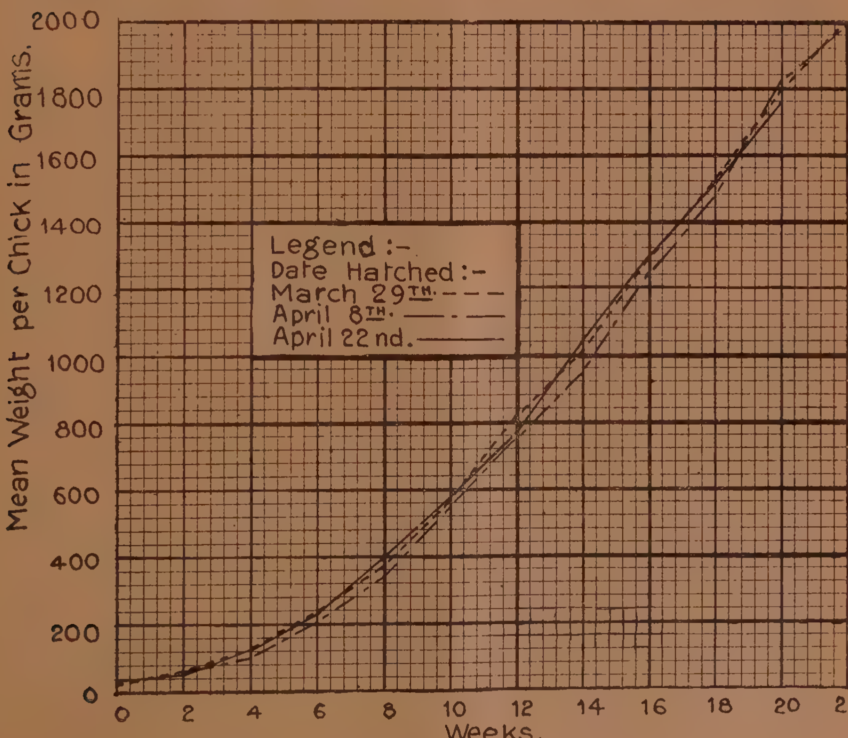



Figure II.—Showing Rate of Growth in Barred Plymouth Rock Male Chicks.



also shows the growth curve for the entire flock of seventy-six chicks. The trend of all curves is regular, though the male chicks increased in weight more rapidly than the female chicks.

The variability in weekly mean weight for both female and male chicks increased, in general, from the first to the fourth week, after which it remained fairly constant up to and including the twelfth week in the female chicks and the tenth week in the male chicks. Thereafter, there was a general tendency toward decrease in variability in weekly mean weight for both sexes, showing that as the chicks grew older they tended to increase in weight more uniformly.

TABLE III.—SHOWING THE WEEKLY MEAN CHICK WEIGHTS FOR THIRTY-EIGHT BARRED PLYMOUTH ROCK FEMALE CHICKS FOR TWENTY-TWO WEEKS

| Week | Mean Weight in Grams | Standard Deviation | Coefficient of Variability |
|---|---|---|---|
| 0 | 33.72 ± 0.42 | 3.57 ± 0.30 | 10.59 ± 0.88 |
| 1 | 41.65 ± 0.47 | 4.04 ± 0.34 | 9.69 ± 0.80 |
| 2 | 62.71 ± 1.08 | 9.16 ± 0.76 | 14.61 ± 1.21 |
| 3 | 76.93 ± 1.57 | 13.37 ± 1.11 | 17.38 ± 1.44 |
| 4 | 110.61 ± 3.28 | 27.91 ± 2.32 | 24.04 ± 2.00 |
| 5 | 163.00 ± 5.39 | 45.93 ± 3.81 | 28.18 ± 2.34 |
| 6 | 203.51 ± 5.65 | 48.09 ± 3.99 | 23.63 ± 1.96 |
| 7 | 259.94 ± 6.83 | 58.17 ± 4.83 | 22.38 ± 1.86 |
| 8 | 330.55 ± 8.41 | 71.67 ± 5.95 | 21.68 ± 1.80 |
| 9 | 400.97 ± 8.81 | 75.07 ± 6.23 | 18.72 ± 1.55 |
| 10 | 504.79 ± 12.90 | 109.89 ± 9.12 | 21.77 ± 1.81 |
| 11 | 600.45 ± 15.74 | 134.07 ± 11.13 | 22.33 ± 1.85 |
| 12 | 673.12 ± 16.62 | 141.52 ± 11.75 | 21.02 ± 1.75 |
| 13 | 746.82 ± 16.60 | 141.35 ± 11.74 | 18.93 ± 1.57 |
| 14 | 829.61 ± 17.57 | 149.65 ± 12.42 | 18.04 ± 1.50 |
| 15 | 942.58 ± 18.43 | 156.98 ± 13.03 | 16.65 ± 1.38 |
| 16 | 1032.88 ± 19.86 | 169.14 ± 14.04 | 16.38 ± 1.36 |
| 17 | 1104.06 ± 18.37 | 156.49 ± 12.99 | 14.17 ± 1.18 |
| 18 | 1195.70 ± 22.03 | 187.62 ± 15.58 | 15.69 ± 1.30 |
| 19 | 1275.91 ± 23.75 | 202.26 ± 16.79 | 15.85 ± 1.32 |
| 20 | 1388.03 ± 26.39 | 224.76 ± 18.66 | 16.19 ± 13.44 |
| 21 | 1471.97 ± 27.73 | 236.17 ± 19.61 | 16.04 ± 1.33 |
| 22 | 1542.05 ± 32.02 | 222.66 ± 22.64 | 14.44 ± 14.66 |

TABLE IV.—SHOWING THE WEEKLY MEAN CHICK WEIGHTS FOR THIRTY-EIGHT BARRED PLYMOUTH ROCK MALE CHICKS FOR TWENTY-TWO WEEKS.

| Week | Mean Weight in Grams. | Standard Deviation. | Coefficient of Variability |
|---|---|---|---|
| 0 | 36.31 ± 0.45 | 3.98 ± 0.32 | 10.96 ± 0.87 |
| 1 | 43.31 ± 0.49 | 4.35 ± 0.35 | 10.04 ± 0.80 |
| 2 | 62.74 ± 0.87 | 7.73 ± 0.61 | 12.31 ± 0.98 |
| 3 | 80.40 ± 1.41 | 12.51 ± 0.99 | 15.56 ± 1.24 |
| 4 | 118.54 ± 3.24 | 28.84 ± 2.29 | 24.34 ± 1.93 |
| 5 | 166.94 ± 4.40 | 39.14 ± 3.11 | 23.45 ± 1.86 |
| 6 | 224.92 ± 5.98 | 53.19 ± 4.23 | 23.65 ± 1.88 |
| 7 | 286.61 ± 7.33 | 65.19 ± 5.18 | 22.74 ± 1.81 |
| 8 | 366.58 ± 8.38 | 74.58 ± 5.93 | 20.34 ± 1.62 |
| 9 | 476.64 ± 11.08 | 98.57 ± 7.84 | 20.68 ± 1.64 |
| 10 | 560.67 ± 16.94 | 150.66 ± 11.98 | 26.87 ± 2.14 |
| 11 | 670.28 ± 13.87 | 123.36 ± 9.81 | 18.40 ± 1.46 |
| 12 | 772.50 ± 16.47 | 146.51 ± 11.65 | 18.97 ± 1.51 |
| 13 | 881.39 ± 16.81 | 149.56 ± 11.89 | 16.97 ± 1.35 |
| 14 | 1000.69 ± 20.78 | 184.84 ± 14.69 | 18.47 ± 1.47 |
| 15 | 1129.61 ± 25.72 | 228.81 ± 18.19 | 20.26 ± 1.61 |
| 16 | 1273.56 ± 24.30 | 216.17 ± 17.18 | 16.97 ± 1.35 |
| 17 | 1394.97 ± 26.17 | 232.75 ± 18.50 | 16.68 ± 1.33 |
| 18 | 1508.78 ± 28.33 | 252.02 ± 20.03 | 16.70 ± 1.32 |
| 19 | 1631.39 ± 29.03 | 258.23 ± 20.53 | 15.83 ± 1.26 |
| 20 | 1742.17 ± 31.37 | 275.18 ± 22.18 | 15.80 ± 1.27 |
| 21 | 1905.14 ± 34.98 | 306.81 ± 24.73 | 16.10 ± 1.30 |
| 22 | 2000.63 ± 41.43 | 299.68 ± 29.30 | 14.98 ± 1.46 |

In order to test the significance of the difference between the weekly mean weights of the female and the male chicks, Table V has been compiled. It will be seen that the differences in weight between female and male chicks is not significant until about the eighth week. It is quite evident that many more chicks should be under observation to determine the possible significance of a difference in growth rates for the first few weeks. After the eleventh week the differences become more significant week by week, which is to be expected. This would seem to indicate that although the female chick weight at hatching time is slightly less than the male chick weight, nevertheless, the females grew as rapidly or more rapidly than the males during the first few weeks, but

Figure III.—Showing Rate of Growth in Barred Plymouth Rock Chicks.

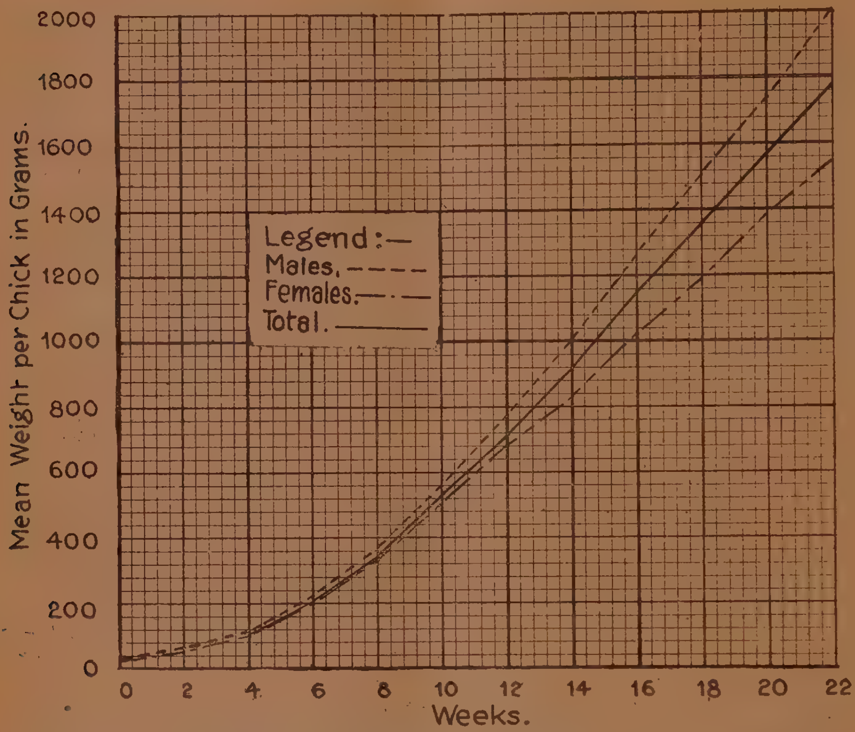



Figure IV.—Showing the Weekly Mean Female Chick Weight as a Percentage of the Weekly Mean Male Chick Weight.

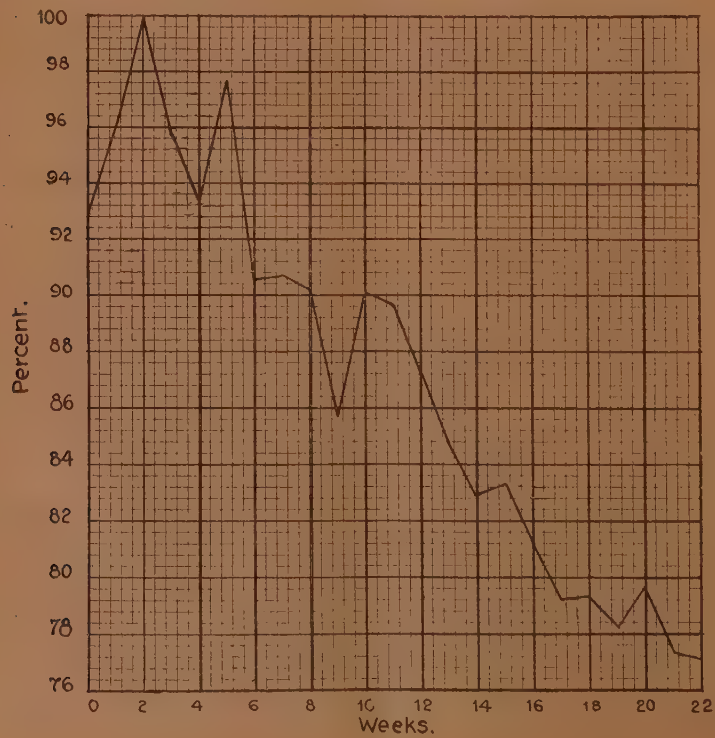


TABLE V.—A COMPARISON OF WEEKLY MEAN WEIGHTS IN FEMALE AND MALE BARRED PLYMOUTH ROCK CHICKS

| Week | P. E. Diff. | Weekly Mean Female Chick Wt. as a Percentage of Weekly Mean Male Chick Wt. |
|---|---|---|
| 0 | 2.59 ± 0.61 | 92.87 |
| 1 | 1.66 ± 0.68 | 96.17 |
| 2 | 0.03 ± 1.39 | 99.95 |
| 3 | 3.47 ± 2.11 | 95.68 |
| 4 | 7.93 ± 4.61 | 93.31 |
| 5 | 3.94 ± 6.96 | 97.64 |
| 6 | 21.41 ± 8.22 | 90.48 |
| 7 | 26.67 ± 10.02 | 90.69 |
| 8 | 36.03 ± 11.87 | 90.17 |
| 9 | 75.67 ± 14.15 | 85.74 |
| 10 | 55.88 ± 21.29 | 90.03 |
| 11 | 69.83 ± 20.98 | 89.58 |
| 12 | 99.38 ± 23.40 | 87.14 |
| 13 | 134.57 ± 23.62 | 84.73 |
| 14 | 171.08 ± 27.21 | 82.90 |
| 15 | 187.03 ± 31.64 | 83.44 |
| 16 | 240.68 ± 31.38 | 81.10 |
| 17 | 290.91 ± 31.97 | 79.15 |
| 18 | 313.08 ± 35.89 | 79.25 |
| 19 | 355.48 ± 37.51 | 78.21 |
| 20 | 354.14 ± 40.99 | 79.67 |
| 21 | 433.17 ± 44.64 | 77.26 |
| 22 | 458.58 ± 52.36 | 77.08 |

after about the eighth week the males assumed a distinct lead over the females and the rates of growth became more widely divergent as the chicks grew older. Since the difference in weekly mean weights for the first seven weeks are not significant, it is apparent that data on many more chicks are required. The two groups of thirty-eight chicks each do show significant differences after the eleventh week.

The rate at which the female chicks increased in weight in relation to the male chicks is shown in Table V and also in Figure IV. This shows quite clearly that the Barred Plymouth Rock female chicks observed in this study grew faster than did their full and half brothers during the first five weeks, and thereafter the rate of growth decreased relatively as compared with the growth rate of the male chicks. It seems well established that in these chicks, after a certain age, the females tend to increase in weight at a progressively slower rate than males.

The conclusion would seem justified that there are differential growth curves in female and male chicks, and that after the first few weeks the female growth rate progresses at a relatively slower rate from week to week, at least up to and including the twenty-second week.

## NOTES

Dr. E. G. Hood (O.A.C. '13, Amherst '22), Lecturer in Bacteriology at Macdonald College, has been appointed Chief of the Division of Dairy Research, a newly created Department in the Dominion Dairy and Cold Storage Branch. Dr. Hood goes to Ottawa in the near future.

Dr. J. H. Grisdale, Deputy Minister of Agriculture, left Ottawa for England on September 14th. He is not expected to return before the latter part of October.

E. L. Small (O.A.C. '16) formerly District Supervisor of Agricultural Instruction at Cloverdale, B. C., has gone to the United States. He is now on the teaching staff of the Northern Normal and Industrial School, Aberdeen, S.D.

G. F. H. Buckley (Alberta '20) is taking post-graduate work in Agronomy at Berkeley, Cal.

D. A. Kimball (O.A.C. '20) has been transferred from the Experiment Station, Vineland, Ontario to the Horticulture Department at the O.A.C.

P. M. Daly (Macdonald '21) is spending the next two months at the Experimental Farm, Summerland, B.C.

# The Valuation of Farm Crops.

## An attempt to demonstrate the usefulness of a unit system for this purpose.

P. A. BOVING,

*Professor of Agronomy, The University of British Columbia.*

The more we study crops and crop yields, the more important do they appear to us. Wherever country people meet and pass the time of the day, they will discuss the weather and the crops: Good weather or bad weather, heavy crops or light crops, are thoroughly dealt with before the conversation drifts on to other subjects.

It is but natural that farmers are interested in crops, since they rely upon them for food and feed. However, not only farmers are concerned with the weather and the crops; all the other classes of the community—and it takes all kinds of people to make a world—feel that their own prosperity and that of the country at large is dependent upon crops. The average street politician, the merchant, the capitalist, the manufacturer and the city laborer, may possess only a vague or rudimentary knowledge of the subject, yet the majority of them realize that they have to be at least indirectly concerned about crops.

And it is not to be wondered at that this subject forms such a common topic of conversation among all classes of people. Expressions such as "nice morning"—"fine day"—"lovely weather"—silly and self-evident as they very often do appear, have originated more or less as an appreciation of satisfactory growing conditions, while on the other hand, "beastly weather"—"terrible drouth"—"rotten day"—and similar expletives—indicate the conscious or unconscious fear on the part of the speaker that prevailing weather conditions may have an undesirable influence on the crop, on the market or the political situation.

Is, however, the vagueness, to which I have referred above, limited entirely to the other classes? Do we, as farmers and agriculturists, clearly and deliberately recognize the high value of an abundant crop or the correspondingly low value of a poor crop, not considering for the moment the bearish influence of, for instance, a high wheat yield on the world market?—To take an example, what is the exact value of one ton of hay? Does the fact that hay on the market fetches sometimes $10.00, sometimes $40.00, really and truly indicate the value of a ton of hay? The cost of production per pound, bushel or ton of any commodity has undoubtedly a very important bearing on the economy in farming. But though some among us may be able to state what it costs, under certain conditions, to produce one ton of hay or one ton of oats, one ton of roots, one bushel of corn or wheat, etc., we cannot judge from such figures regarding the relative acre value of these different crops. To obtain a real conception of the comparative value between two crops, we must know not only the cost of production in comparison with prevailing market prices, but, what is just as important, we should have an accurate knowledge of the quantity required of one certain feed to correspond in feeding value to a certain quantity or weight of another feed.

When a man reports that he has harvested three tons of hay per acre, or 2,000 lbs. (59 bus.) of oats with corresponding straw, or 14 tons of ensilage corn, or 30 tons of roots, we have to admit in all fairness that he has done quite well. Of course, if we are his neighbors and not superhuman, we like to be able to state, when commenting upon the fact to another neighbour, that we ourselves did just a little better. What is, however, the intrinsic value of these acre yields? Do 3 tons of hay represent more or less in feeding value than 2,000 lbs. of oats, or than 30 tons of roots, or than 14 tons of corn? How far will these amounts, or other amounts of other feeds, go towards the feeding of cows, horses, pigs or other animals? Which kind of crop will, under normal conditions, secure the maximum amount

of feed per acre, and which feed is the cheapest to produce?

If and when we can answer these questions correctly, we have gone a long way towards a correct valuation of crops.

During the development and growth of agricultural practice and knowledge different systems of valuation have been advocated, tried and in most cases abandoned. Albrecht Thaer's "Hay Unit", is one example of this kind; "The Concentrate Unit", which was based on the price of the commodity, is another. Within the last forty years another system, namely, the so-called "Scandinavian Feed Unit System," has been widely applied for the purpose of comparing the value of different feeds for cows and other animals. It is worth mentioning that the recognized authority on feeding in America, Dr. W. A. Henry, states in one of his publications: "The Scandinavian System of using feed units for studying and comparing individual cows, herds and associations and the co-operative efforts of these associations toward the betterment, merit the highest praise. This system is simple, easily understood and capable of the widest usefulness."

In this article, I shall endeavour to show that the feed unit system applied to crop valuation does enable us to make a quick and correct calculation of relative acre yields and that it permits us to figure out in a very short time whether a certain feed supply is sufficient or not in a certain given case. Before continuing this task, I may be permitted to state, for the information of those readers who are not familiar with feeding theories, that *the feed unit constitutes one pound of wheat or its equivalent of other feeds.* It might also be well to enumerate the four short and comprehensive rules, which have been established through practical feeding experiments conducted with thousands of dairy cows under conditions where economic feeding is not a matter of choice, but a question of dire necessity. A cow needs:

A. *For Maintenance*: 1 feed unit for each 150 lbs. of live weight.

B. *For Production*: 1 feed unit for each 3 lbs. of milk produced.

C. *For Maintenance*: .065 lbs. digestible protein for each 100 lbs. of live weight.

D. *For Production*: .045 lbs. digestible protein for each pound of 3.5% milk produced.

The application of these rules may be visualized from the following example which pertains to a cow weighing 1050 lbs. and producing 30 lbs. of milk per day. For her daily ration this animal would need:

A. *For Maintenance*: $\frac{1050}{150} = 7$ feed units

B. *For Production*: $\frac{30}{3} = 10$ feed units

Total ................ 17 feed units

To cover the protein requirements of the animal such feed should contain:—

C. *For Maintenance*: $\frac{1050\text{x}.065}{100} = .6825$ lbs. digestible protein.

D. *For Production*: 30x.045= 1.35 " "

In the following table the left hand column indicates the average number of pounds of some of our more common feeds which in the experiments referred to above have proved to be the equivalent of one feed unit. Thus for instance,—8/10 of 1 lb. of peanut cake, 9/10 of 1 lb. of linseed meal, 1.2 lbs. of oats, 2.5 lbs. of mixed clover hay, 5 lbs. of oat straw, 8 lbs. of ensilage corn (from the field), 10 lbs. of mangels, and 15 lbs. of mangel tops, etc., each constitute one feed unit. This means that each of these quantities can substitute for the other in a normal ration, i.e., in a ration which satisfies the requirements of a cow in regard to bulk, succulence, variation, palatability and content of protein. The first right hand column gives the average number of feed units per ton of feed, and the two remaining columns, which are of less interest only in so far as the present discussion is concerned, indicate the average percentage of digestible protein and of amides in the respective feeds.

If we compare the figures we find that, broadly speaking, the higher the percentage of protein, the lower the figure for equivalence. Peas and beans are noteworthy exceptions to this general rule in that, although these two grains contain 2 to 3 times as much protein as, for instance, wheat and corn, the comparative effectiveness of these four feeds has proven to be identical. The figures for equivalence, it should be observed, are

## TABLE I.

### Feed Unit Table.

| Average number of lbs. equivalent to 1 feed unit | | Average number of feed units per ton | Avg. percentage Digestible protein | Amides |
|---|---|---|---|---|
| .8 | Peanut Cakes .. | 2500 | 39.6 | 1.4 |
| .85 | Soy Bean Meal.. | 2353 | 40.1 | 1.8 |
| .85 | Cotton seed cake (decorticated) . | 2353 | 35.9 | 1.4 |
| .9 | Linseed Cake .. | 2222 | 24.2 | 1.6 |
| .95 | Gluten Feed .... | 2105 | 19.4 | 1.5 |
| 1.0 | Wheat ......... | 2000 | 9.3 | 1.2 |
| 1.0 | Corn .......... | 2000 | 6.5 | .7 |
| 1.0 | Beans (Horse) . | 2000 | 19.3 | 2.8 |
| 1.0 | Peas .......... | 2000 | 17.2 | 3.0 |
| 1.2 | Oats .......... | 1666 | 7.7 | 1.0 |
| 1.2 | Bran .......... | 1666 | 10.8 | 1.8 |
| 2.2 | Alfalfa Hay .... | 909 | 8.1 | 4.1 |
| 2.5 | Mixed Clover Hay | 800 | 4.2 | 1.5 |
| 3.5 | Pea Straw ...... | 571 | 3.5 | .9 |
| 4.0 | Potatoes ....... | 500 | .4 | .7 |
| 4.0 | Oat Straw ...... | 500 | 1.1 | .2 |
| 6.0 | Skim milk ...... | 333 | 3.4 | |
| 7.0 | Corn Ensilage—(from silo) .... | 285 | 1.3 | 1.1 |
| 8.0 | Ensilage corn—(from field) .... | 250 | .9 | .8 |
| 10.0 | Mangels, Swedes, Carrots ....... | 200 | .5 | .5 |
| 10.0 | Carrot Tops ... | 200 | 1.0 | .5 |
| 12.5 | Soft or Fall Turnips .......... | 160 | .4 | .5 |
| 15.0 | Mangel, Swede and Turnip Tops | 133 | .9 | .6 |

not based on theoretical speculations, but are the outcome of numerous comparative feeding experiments conducted with a large number of animals over a long series of years.

To demonstrate how this feed valuation may be used for the calculation of crops, I shall take a one hundred acre farm as an example. Let us suppose that this farm is divided in a four year rotation:

1. Grain (seeded down).........25 acres
2. Clover (1st year) ..............25 acres
3. Hay (2nd year) ..............25 acres
4. Hoed crops (20 acres corn and 5 acres mangels) ..........25 acres

Let us further for the sake of comparison use the same figures for yield as quoted in the introduction and assume, that in a certain year the farm gives the following yields per acre: 2000 lbs. of oats + 4000 lbs. of straw; 3 tons of hay; 14 tons of corn; and 30 tons of mangels + 5 tons of tops. This means that the owner would have at his disposal 25 tons (50,000 lbs.) of oat grain, 50 tons (100,000 lbs.) of oat straw, 150 tons of hay (or its equivalent in pasture), 280 tons of corn for ensilage, and 150 tons of roots + 30 tons of tops.

While I feel quite certain that everyone of my readers will agree that these amounts represent fairly large quantities of feed for a farm of this size, I am not so certain that the majority are able to state what these crops are worth for feeding purposes and what their relative value actually amounts to. It shall be my aim to demonstrate in the following paragraphs how a unit system, in this case the Feed Unit System, lends itself admirably for this purpose. The demonstration may gain in clarity if we begin by considering the acre yield and from that work up to a calculation of the feeding value of the total yield. In the following table the acre yield has been computed into feed units, and the cost per feed unit has been obtained by dividing the number of feed units into the approximate cost of production per acre.

## TABLE 2.

### Acre Yield and Feed Unit Value of Different Crops.

| Yield per Acre | Average number of feed units per ton | Feed Units per Acre | Cost of production $ | Cost per Feed Unit c. |
|---|---|---|---|---|
| 1 ton Oat Grain | 1666 | 2666 | 29.00 | 1.08 |
| 2 " " Straw | 400 | | | |
| 3 tons Mixed Clover Hay . | 800 | 2400 | 18.00 | .75 |
| 14 tons of Ensilage Corn ... | 250 | 3500 | 40.00 | 1.14 |
| 30 tons Mangels | 200 | 6798 | 60.00 | .88 |
| 6 " " tops | 133 | | | |

The cost of production per acre naturally varies from farm to farm, and the figures given above, consequently, do not apply to every case. The outstanding facts to be observed are, that under these conditions roots

and corn have given the greatest number of feed units per acre, and that in spite of high cost of production per acre for hoed crops, the cost per feed unit is nevertheless relatively low. Where an average yield of 3 tons of hay per acre or more can be counted on, we generally find that one feed unit of hay is obtained at a lower cost than with other crops, in spite of the comparatively small number of feed units per acre.—Incidentally, I beg to point out that the relation found in Table 2 is not by any means uncommon, and it has been evidenced in eastern Canada (Quebec and Ontario) as well as in the Province of British Columbia, where I have had an opportunity to check up reliable figures for yield.

The four horses, which would normally be kept on a farm of this size, require a certain amount of hay, oats and straw, and of the remaining straw about ¾ will be needed for bedding purposes. Without going into any details in this connection, we will have to deal with the following quantities of feed in our calculations as to how many cows the total crop will sustain:

TABLE 3.

Available Cow Feed on a 100-Acre Farm (Feed for 4 horses and bedding straw deducted)

| | | |
|---|---|---|
| 17 tons of Oat grain | = | 28,322 feed units |
| 10 tons of Oat Straw | | 5,000 " |
| 140 tons of Clover Hay | | 112,000 " |
| 280 tons of Ensilage Corn | | 70,000 " |
| 150 tons of Mangels | | 30,000 " |
| 30 tons of Mangel Tops | | 3,990 " |
| Total .................... | | 249,312 feed units |

Provided that all feed could be stored and preserved successfully, the farmer in question would have 249,000 feed units at his disposal. However, in order to be on the safe side in our calculations, it would be advisable to discount at least 10% or 24,900, say 25,000 feed units for shrinkage. Our question then is: How many cows or cow units will the remaining 224,000 feed units sustain? Assuming that his cows weigh 1050 lbs. on an average, and further that they produce 7,300 lbs. of milk per year we can easily calculate the needs of a cow by applying the previous rules, i.e., that a cow needs as maintenance ration one feed unit for each 150 lbs. of live weight and as production ration one feed unit for each 3 lbs. of milk produced. From this we obtain the following equations:

*For Maintenance*: $\frac{1050 \times 365}{150} = 2555$ feed units

*For Production*: $\frac{7300}{3} = 2433$ feed units

Total ............... 4988 feed units

Cows of this size and with the cited production require 5,000 feed units per year in round figures. Without taking into consideration the protein requirements of the cows, we find that $\frac{224,000}{5000} =$ slightly over 44 cow units could be kept on the farm in question. It may be contended that this is a large number of animals on a 100 acre farm, and, judging from average conditions prevailing on our Canadian farms, I shall willingly admit that the figures seem large. On the other hand there is really no reason why we should not be able to maintain such a number. Instead of keeping one cow to every 8 or 10 acres, we should be able, and may in time be forced to be able, to maintain a cow on every four or three or two acres, and why not one cow on every acre in certain favourable districts? It is done here in Canada in a few isolated cases, and is not uncommon under European farming conditions which are not nearly as favourable for crop production as those prevailing in certain parts of the Dominion.

In the previous discussion we have not considered the value of pasture. It is only correct to assume that as a general rule the same number of feed units are required during the summer as during the winter for the maintenance of the cows and for the production of a certain amount of milk. Whether a pasture field can be credited for the full amount of feed will depend on its ability to maintain the live weight of the animals as well as the milk flow. There are such immense variations as regards the quality of pasture in different parts of the country, and in different seasons, that hard and fast rules cannot be laid down for this valuation. Dry cows and low milkers keep well on pasture and are often found to gain in weight. High milkers on the other hand very often

lose in weight on pasture, especially when no extra feed is given. This problem also has been the object of carefully conducted experiments in Sweden, as well as in Denmark, and the following figures for debiting the animals and consequently crediting the fields are commonly accepted:

TABLE 4.

Valuation of Pasture.

| Group | Feed Units per day |
|---|---|
| Calves less than 3 months | 6.5 |
| Calves 3 months to 1 year | 7.5 |
| Young stock 1—2¼ years | 10. |
| Heifers over 2¼ years | 12. |
| Dry cows and low milkers (averages) | 12. |
| High producing cows (averages) | 17. |
| Young horses | 13. |
| Work horses | 17.5 |

This means that whatever is the average price per feed unit, and where one desires to keep approximately accurate field accounts, the price should be multiplied by the number of feed units consumed and the animals debited with the corresponding amount. If we go back to Table 2, we find that, in this example, the average price of one feed unit produced on the farm is about 1c. Consequently in the case of a cow weighing 1050 lbs. and producing 30 lbs. of milk per day, the pasture field should be credited with 17c for this particular animal. Where, for one reason or another, additional feed is given during certain periods of the pasturage, such feed can be converted into feed units, which then may be deducted from the above figures.

It is generally recognized that the most economical way of feeding animals is to produce the crops at home, or, in other words, to let one department of the farm buy from the other. However, for want of a simple system of calculation, very few farmers give their fields full credit for what they actually produce, and this is one of the reasons for the quite common misconception regarding the relative value of field crops when used as feed for our domestic animals.

## WOOLLEN GOODS AT REDUCED PRICES

A special arrangement has recently been completed between the Canadian Co-operative Wool Growers Limited and the General Secretary of the C.S.T.A., whereby any member of the Society may obtain manufactured woollen goods at reasonable prices. This will include suitings, underwear, socks, motor rugs, blankets, etc.

The Canadian Co-operative Wool Growers Limited has offices at Regina, Sask., Toronto, Ont. and Lennoxville, P.Q., and those in charge at these branch offices are all charter members of the C.S.T.A.. The Lennoxville office will handle orders from members resident in Quebec and the Maritime provinces; the Toronto office will deal with members in Ontario; members resident in Manitoba, Saskatchewan, Alberta and British Columbia will use the Regina office.

Catalogues and samples of suitings (if required) can be obtained on request. All correspondence should be addressed as follows:

Ontario Members—W. H. J. Tisdale, 128 Simcoe St., Toronto, Ont.

Quebec and Maritime Provinces— L. V. Parent, Lennoxville, P.Q.

Manitoba and Western Provinces—W. W. Thomson, Creamery Building, Regina, Sask.

## ROYAL AGRICULTURAL WINTER FAIR.

Every Winter Fair conceived on the lines of the Royal Winter Fair, which will hold its second annual show in the Royal Coliseum, November 20-28 inclusive, has been a source of education and inspiration. Representing the process of evolution in every branch of the show the Royal cannot be compared to the community, county or Provincial fair. It combines all three, and then extending their activities carries them into enlarged fields of national and international competition.

In planning the show the management has given special attention to educational features which are tempered by just enough wholesome entertainment to give a well balanced programme. The light horse show given every afternoon and evening in the ring of the Royal Coliseum amphitheatre has already taken root as the Dominion's outstanding horse event, and brings the finest stables of Canada and the United States into competition.

# L'Enseignement Agronomique Superieure de Demain.*

EM. MARCHAL

*Membre de l'Académie Royale des Sciences de Belgique, Professor à l'Institut Agronomique de l'Etat à Gembloux.*

Dans presque tous les pays du monde existe, à l'heure actuelle, un enseignement agronomique que l'on qualifie de supérieur et qui représente en tous cas, pour chacun d'eux, dans le domaine des études techniques, le degré le plus élevé de la hiérarchie didactique.

Toutefois, la question du rôle précis dévolu à cet enseignement, comme celle de son organisation, font l'objet de vives controverses. Il en résulte que, tiraillé entre des tendances inconciliables, l'enseignement agronomique apparaît, dans certains pays, comme désemparé et menacé d'une véritable crise si l'on n'y porte bientôt remède. Aussi semble-t-il opportun de chercher à déterminer quelle est l'orientation de ces hautes etudes la plus conforme aux besoins actuels et généraux de l'agronomie.

A en juger d'après l'état d'esprit qui se manifeste notamment en Belgique, deux courants d'opinion s'affirment et s'opposent à cet égard, dans les milieux intéressés.

Dans certains d'entre eux, on reproche à l'enseignement supérieur agronomique, tel qu'il est organisé, d'être trop théorique, de ne pas mettre assez l'étudiant aux prises avec les réalités de la pratique. Que de fois on entend dire: "L'enseignement de nos instituts agronomiques est beaucoup trop savant; il communique aux fils de cultivateurs des aspirations scientifiques trop élevées et, au lieu de les préparer à la vie rurale, tend plutôt à les éloigner de la terre".

Pour ceux qui ont cette conviction, le rôle essentiel de ces instituts est d'initier soigneusement, à la fois théoriquement et pratiquement, des jeunes gens, issus de préférence des classes directement intéressées à l'exploitation du sol, aux méthodes les plus perfectionnées de la production, d'en faire des techniciens instruits qui, par leur exemple et leur influence morale, s'érigent, dans la suite, en apôtres ecoutés du progrès agronomique.

Le souci de s'attacher la clientèle rurale inspire dans cette conception, à l'organisation des études, les caractéristiques suivantes: accession relativement aisée, durée modérée, préoccupation constante d'orienter l'enseignement, y compris celui des sciences fondamentales, vers l'application directe, predominance des exercises pratiques à la ferme et dans les champs sur les travaux de laboratoire et les séances de séminaire.

L'autre tendance est représentée par ceux qui pensent que le rôle de l'enseignement agronomique supérieur est, non seulement de former des vulgarisateurs des progrès acquis, mais aussi, et même surtout, de préparer les hommes d'avant-garde, les chercheurs, les artisans des progrès futurs. Pour ceux-là, l'enseignement de nos instituts agronomiques, abandonnant toute préoccupation professionnelle, doit renforcer encore son caractère scientifique et prendre délibérément place dans le concert des hautes études universitaires.

J'ai, pour ma part, au cours d'une carrière professorale déjà longue, acquis la conviction que c'est dans cette dernière voie que l'enseignement agronomique est appelé à servir le mieux les intérêts particuliers de l'agronomie et les intérêts généraux de la société.

L'histoire des grandes découvertes qui, au cours de ces cinquante dernières années, ont amené la transformation de l'art, jusqu'alors rudimentaire et empirique, de cultiver la terre, en une industrie complexe et raisonnée, montre à chaque pas l'empreinte de l'intervention de la science pure.

De même que ce sont les découvertes des chimistes et des physiologistes de laboratoire qui ont permis, à la fin du dernier siècle, d'edicter les lois fondamentales qui règlent la

*Revue Internationale de Renseignements Agricoles, Institut Internationale d'Agriculture.

production végétale et animale, ce sont les concepts purement abstraits des biologistes qui sont, à l'heure actuelle, mis à profit pour rechercher les moyens d'augmenter encore la productivité de la terre.

Ne sont-ce pas, en effet, les patientes et arides recherches de Mendel, reprises et amplifiées par une pléiade de chercheurs, qui ont fait franchir au savoir humain, dans ce domaine mystérieux entre tous de l'hérédité, les premières étapes décisives. Avec les conceptions de Vries sur la mutation, de Johanssen sur les lignées pures, celle de l'hérédité mendélienne, fermement appuyée aujourd'hui sur les données de l'observation cytologique, domine la génétique, cette discipline si merveilleusement féconde de la biologie, sans le concours de laquelle la sélection des races animales et végétales n'est que pur empirisme.

Dans un autre domaine, ne sont-ce pas les acquisitions purement théoriques des mycologues de laboratoire et des entomologistes qui, en faisant connaître jusque dans ses détails les plus infimes l'évolution des parasites, ont permis d'asseoir, sur des bases rationnelles, le traitement des ennemis et des maladies des plantes?

Ne sont-ce pas les investigations délicates entre toutes des bactériologistes et des protistologues qui commencment à projecter une certaine lumière sur la vie microbienne du sol et entr'ouvrent la perspective d'intéressantes et fructueuses applications?

Partout, toujours, la science pure constitue la source vive de laquelle découlent, souvent il est vrai après de longs et nombreux détours, mais toujours sûrement, les progrès techniques. Les étapes de cette genèse sont, en effet, multiples. La conception théorique est presque toujours l'oeuvre de savants que ne préoccupe nullement la portée utilitaire de leurs recherches; c'est le rôle d'esprits moins originaux, mais à tendance pratique, d'en saisir le portée éventuelle dans le domaine de l'application. Puis viennent la mise au point de la théorie nouvelle, l'epreuve pratique du procédé original et, enfin, leur diffusion parmi les masses intéressées, leur vulgarisation.

Quoi qu'il en soit, si l'on cherche à déterminer le rôle joué par les institutions d'enseignement et de recherches agronomiques dans l'élaboration de l'oeuvre grandiose de la rénovation scientifique de l'agriculture, on est amené à constater que ce rôle a été, avant tout. d'assurer la liaison nécessaire entre la science pure, génératrice, et la pratique, de discerner, parmi les conceptions originales et abstraites des savants de laboratoire, les idées susceptibles d'application, de mettre celles-ci au point, de les adapter aux nécessités d'une heureuse réalisation technique et enfin, et surtout, de les vulgariser. Le rôle véritablement créateur de ces milieux, cependant éminemment laborieux, a été, en général, relativement effacé.

La cause de cette situation est à rechercher, avant tout, dans le mode de recrutement des maîtres et des chercheurs pour lesquels on accorde souvent moins d'importance à une haute formation scientifique qu'à la compétence technique, qu'au "sens pratique", sans lequel, croit-on, une science, même transcendante, reste dans le domaine appliqué, souvent stérile.

Il en résulte que trop souvent les pionniers qualifiés des progrès agronomiques ne sont pas, faute d'une préparation scientifique suffisante, à même d'aborder, dans des conditions favorables, la recherche originale. Il ne saurait d'ailleurs guère en être autrement, attendu que la pépinière qui les forme et au sein de laquelle on les recrute avec un exclusivisme souvent exagéré, l'enseignement agronomique supérieur, est souvent marqué de la même tare fondamentale.

Combien, au contraire, la marche du progrès agricole serait plus rapide et plus sûre; que de laborieux et coûteux tâtonnements, de mises au point pénibles, seraient évités, si nos agronomes, supérieurement outillés dans le domaine de la science pure, pouvaient alimenter directement leur activité aux sources primordiales des grandes découvertes.

Envisageant les grands problèmes à la lumière de leurs connaissances pratiques, orientant, dès leur genèse, les conceptions abstraites vers l'application, ils seraient à même de faire produire à la science, dans le domaine de la technique, un "rendement" beaucoup plus élevé.

C'est, à mon avis, de tels collaborateurs scientifiques, aptes à aborder avec succès la recherche originale, beaucoup plus que d'habiles techniciens ou de purs vulgarisateurs, que l'agronomie, ce mot étant pris dans sa conception la plus large, a aujourd'hui le plus urgent besoin.

Il convient de réserver à l'enseignement supérieur agronomique le soin de les préparer; mais, pour être à la hauteur de cette tâche, ce dernier doit, dans beaucoup de pays tout au moins, évoluer, améliorer ses méthodes et son organisation.

Examinons quel pourrait être le cadre idéal de l'enseignement propre à former ainsi les hauts conseillers scientifiques de l'agronomie.

Cette formation comporte nécessairement deux parties: la préparation scientifique générale et l'éducation technique.

La première constitue, par sa nature hautement encyclopédique, la caractéristique même de l'enseignement agronomique; elle comporte en effet les sciences mathématiques, les sciences physico-chimiques, les sciences minérales et les sciences biologiques.

Dans chacun de ces domaines, l'étudiant agronome doit à mon avis recevoir un enseignement qui ne le cède, ni en ampleur ni en élévation, à celui qui prépare aux doctorats purement scientifiques. J'estime, en effet, que l' "orientation des études vers l'application", dont on abuse fréquemment dans la méthodologie des sciences préparatoires aux grades techniques, constitue un grave danger, car elle conduit à négliger parfois complètement, sous prétexte qu'ils sont abstraits et dénué d'intérêt pratique actuel, des chapitres entiers de la science qui peuvent dans la suite la source d'importantes applications. Une telle conception aboutit à former des esprits incomplets, dont l'horizon et le champ d'investigations restent limités et qui seront toujours incapables d'aborder fructueusement la recherche originale.

C'est l'Université, avec ses grands maîtres de la pensée, ses immenses et précieuses ressources didactiques, qui constitue l'ambiance la plus favorable pour la formation purement scientifique des futurs ingénieurs-agronomes.

Il ne sera pas difficile, par des emprunts judicieux, effectués aux programmes de nos facultés, de constituer de toutes pièces une candidature préparatoire aux études agronomiques absolument idéale.

Sur ces bases solides de sciences générales, le futur ingénieur-agronome, poursuivant sa formation méthodique, pourra édifier son éducation technique. C'est ici qu'intervient seulement la Faculté technique agronomique ou, en d'autres termes, l'Institut agronomique.

Installé à la campagne, dans l'ambiance rurale, où son enseignement doit puiser à chaque pas les éléments vivifiants de sa démonstration, ce dernier doit, avec sa ferme expérimentale, ses stations de recherches peuplées de spécialistes éminents, constituer un foyer de science appliquée qui restera en relations directes et constantes avec le grand centre d'intellectualité générale que représente une ville universitaire et dont, par conséquent, il ne pourra être trop éloigné.

L'organisation des programmes, la méthode de cet institut, s'inspireront, non plus des préoccupations essentiellement désintéressées de la science pure, mais des exigences plus tangibles, plus réalistes, de la science appliquée.

Toutefois, pour conserver à la formation technique le caractère d'élévation qui s'impose, divers écueils sont à éviter.

Il existe une tendance manifeste, dans certaines écoles spéciales, qualifiées cependant de supérieures, à faire dégénérer l'enseignement technique en une initiation, pour ainsi dire professionnelle, à la pratique de telle ou telle industrie ou de telle ou telle spéculation agronomique. Sous couleur d'applications, d'exercices pratiques, on en arrive à faire accomplir à l'étudiant des opérations, des travaux manuels qui peuvent s'apprendre beaucoup mieux après les études, au cours de ce stage auquel tout ingénieur devra se soumettre avant d'aborder le carrière.

Apprendre à l'étudiant à observer, à mesurer, à analyser, à compléter ses connaissances par la documentation, l'initier à la méthode

expérimentale et à la recherche personnelle, tel doit être le thème des applications dans l'enseignement technique supérieur.

Celles-ci, ajoutons-le, doivent tendre à prendre, dans les horaires, une place de plus importante, car leur valeur didactique est inestimable.

C'est, en effet, au cours des applications et des séances de séminaire que le professeur pourra le mieux exercer son rôle d'initiateur et de guide éclairé; c'est aux prises avec la réalité des faits qu'il pourra le mieux témoigner de sa maîtrise et acquérir l'ascendant moral qui fait que l'etudiant respecte et honore en lui la science et l'habileté technique. C'est alors aussi qu'il pourra le mieux inculquer à ses élèves le goût et la méthode de la recherche, en éveillant leur curiosité soit sur la marche et les résultats de ses propres travaux, soit sur d'autres objects susceptibles de servir de substratum à l'étude originale. Enfin, les applications fourniront au professeur l'occasion d'asseoir, sur des bases moins fragiles que celles de l'examen, une saine appréciation de la valeur et des connaissances de l'étudiant.

Pour ce dernier, les exercices pratiques seront l'occasion d'acquérir les connaissances les plus solides, les plus durables, de développer son esprit d'initiative, de mettre à l'épreuve ses aptitudes et de contrôler lui-même son savoir.

Mais, comme je le disais plus haut, l'objet des démonstrations et des exercices pratiques doit rester élevé, car le temps que l'étudiant passe dans l'enseignement supérieur est trop précieux pour qu'il puisse être employé à l'accomplissement de travaux purement professionnels.

Un autre écueil à éviter, à mon avis, dans l'enseignement agronomique, est de verser dans une spécialisation exagérée.

Certes, l'agronomie constitue, dans son ensemble, un domaine trop vaste pour que l'on puisse demander à un homme d'en faire l'étude technique complète. L'agriculture de nos régions, celle des pays tropicaux, la sylviculture, l'horticulture, la zootechnie, la chimie et la technologie agricoles, le génie rural constituent des domaines dont l'étude peut être avantageusement intensifiée dans la formation de classes distinctes d'ingénieurs-agronomes.

Mais il faut veiller à sauvegarder la formation agronomique d'ensemble qu'une spécialisation outrancière mettrait en danger, éviter de former des hommes incomplets qui, bien qu'instruits dans les détails les plus minutieux d'une technique déterminée, restent, faute de la connaissance suffisante des méthodes générales et des grands principes,, incapables de s'adapter, de voir ce qui se passe en dehors des limites étroites de leur champ habituel d'actitivité.

*Haute culture scientifique préparatoire, puissante formation technique générale, spécialisation modérée*, telles doivent être, à mon sens, les conditions auxquelles doit satisfaire l'ingénieur-agronome de demain.

Hâtons-nous de dire que ce programme est, à l'heure actuelle, tout au moins dans ses lignes essentielles, déjà réalisé dans plusieurs pays.

Ceux-là ont compris qu'en agronomie l'ère des victoires relativement faciles et de la grande vulgarisation est close, que, pour arracher à la nature le secret de richesses nouvelles, pour réaliser ce que l'humanité appauvrie réclame impérieusement en ces jours troublés d'après-guerre: une augmentation de la productivité de la terre, il faut faire un appel de plus en plus pressant à la collaboration de la seule puissance génératrice de progrès: la science.

# Concerning the C.S.T.A.

## Executive Council Meeting.

A meeting of the Executive Council was held at Ottawa on September 14th for the purpose of considering a number of matters arising out of the Saskatoon Convention, as well as to consider some new business. Those present at the meeting were H. Barton, President of the Society; Arthur Gibson, Dominion Entomologist; T. G. Bunting, Macdonald College, and Fred H. Grindley, General Secretary.

### Agricultural Instruction Grant

It was decided to ascertain immediately what action the various provinces are taking in regard to a renewal of the Federal Grant for Agricultural Education, which expires on March 31, 1924. When this information is obtained the Council will consider further the possibility of an organized campaign by the Society, in an effort to ensure a continuance of the Grant for a further period of years.

### Publication of Who's Who

The Council agreed to proceed immediately with the preparation, arrangement and publication of a "Who's Who in the C.S.T.A.", in order that much of the information now on file in the Bureau of Records may be distributed to professional agriculturists in Canada and other countries. The members will be classified alphabetically under about twenty divisions of agriculture. Several indexes will also be embodied in the volume, which will be bound in cloth and not in a loose-leaf form, as was at first contemplated. No information as to salaries will be published.

The total cost of publication is likely to approach $3.00 per volume, but a pre-publication offer is being made to members of the Society in this issue at $2.00. This offer will close about December 15th, and it is expected that the "Who's Who" will be ready for mailing on January 15th, 1924.

Whether future revised editions of this volume will be published by the Society, will depend upon the response received by this first effort, and upon the decision of future Executive Committees. It is unlikely that re-publication will be considered more frequently than once in five years, and consequently an effort should be made to enrol as many new members as possible now, in order that the first edition many be fully representative of the professional workers in Canadian agriculture.

### C.S.T.A. Insurance

The General Secretary reported some progress in the matter of special premiums for C.S.T.A. members taking out life insurance. Some form of group insurance appears to be possible but consultation with a number of companies is necessary before any definite decision can be made. Further announcements will be made later.

## Activities of Local Branches.

### MARITIME PROVINCES.

During the month of August, the General Secretary spent one week in the Maritime provinces, and local meetings were held in each province at the time of his visit: Fredericton, N.B., August 13 and 14; Charlottetown, P.E.I., August 16; Kentville, N.S., August 20th and 21st.

The meetings in New Brunswick and Nova Scotia took the form of "Field Days". At Fredericton the members met at the Dominion Experimental Farm. Visits were made to the experimental plots, an informal evening was spent at the home of Mr. C. F. Bailey, Superintendant of the Farm, and the following morning was occupied by a business meeting. This provided an opportunity for all to become familiar with the work being done in New Brunswick by Federal and Provincial officials.

The Nova Scotia meetings opened at Kentville where the whole day was spent at the Dominion Experimental Farm. At noon a luncheon was held at the Cornwallis Inn, where the General Secretary addressed the members. At 4.30 in the afternoon, those at the meeting were driven to Kingsport, and after supper, crossed the Minas Basin to Parrsboro by boat. Here they were again met by cars and driven to Nappan, where the following morning was spent at the Experimental Farm. The meeting closed with a luncheon at the home of W. W. Baird, Superintendent.

At Charlottetown, an evening meeting was held in the offices of the Dominion Live Stock Branch, and this was very well attended. Addresses were given by Mr. E. S. Archibald, Director of Experimental Farms, and by the General Secretary of the Society.

A joint meeting of the three maritime locals will be held at Amherst, N.S., in December at the time of the Winter Fair.

## QUEBEC

Monthly luncheons have been held by the Montreal Branch at the "Cercle Universitaire". These meetings have proved very attractive and it is intended to continue them throughout the winter months. One prominent speaker is selected to address the members, and this is followed by a business discussion which usually extends well into the afternoon.

The Macdonald College local has held no summer meeting, but has arranged a two day Convention for September 27th and 28th.

## ONTARIO.

A summer meeting of the Eastern Ontario local was held on August 4th, when about thirty members motored from Ottawa to the Agricultural School at Kemptville. Mr. W. J. Bell, Principal of the School, received the visitors, who were shown over the experimental plots, and entertained to supper.

This form of summer meeting was considered to be very successful, and similar outings will be arranged next year.

A regular series of winter meetings will be held at Ottawa, commencing in November.

No meetings of the Western Onta local have been held since June, but a lar gathering is likely to be arranged in Toro to at the time of the Royal Winter Fair.

The membership in this local continu to increase, and now stands at 101.

## PRAIRIE PROVINCES.

No meetings have been held in Manitob Saskatchewan or Alberta during the summ months, but each of the branches will com mence its winter activities at an early dat

## BRITISH COLUMBIA.

The B. C. Branch in co-operation wi the O.A.C. Alumni Association of B.C. hel a Basket Picnic in Stanley Park, Vancouve this summer. Those taking part in th affair experienced a most enjoyable outin and reunion.

During the Provincial Exhibition at Ne Westminster, held from September 10th t 15th, the Branch maintained a Registratio and Lounge Booth on the Fair Grounds This booth was used by the members an their friends in many ways and can be con sidered as a successful experiment.

On Friday, September 14th, about 3 members and friends made a motor trip t inspect the Sumas Lake Reclamation Project This excursion was made possible throug the kindness and co-operation of the Pro vincial Minister of Agriculture, the Hon. E D. Barrow, and the officers of the Provin cial Land Settlement Board under Col. R D. Davies. Much valuable information a to the acreage and estimated future possibili ties of the area reclaimed for agricultura production was obtained.

---

## APPLICATIONS FOR MEMBERSHIP.

J. A. Gray (Toronto, 1922, B.S.A.) East End Sask.

S. W. King (Toronto, 1920, B.S.A.) Niagara on-the-Lake, Ont.

J. K. Richardson (McGill, 1921, 1922, B.S.A. M.Sc.,) Fredericton, N.B.

H. R. Sayer (Birmingham, 1900) Vancouver B.C.

J. R. Sutherland (Toronto, 1922, B.S.A.) Sus sex, N.B.